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IN THIS ISSUE

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SAVE THE BRAIDWOOD FOSSIL BEDS

At a recent meeting of the Board of Directors of the Earth Science Digest, attention was called to the situation of the fossil beds in the Braidwood area mine dumps where extensive tracts have been leased by the International Harvester Co. for experimentation with large scale earth moving equipment. Such work will spoil the area for fossil collecting.

It is the general policy of every state under broadminded leadership to husband its attractions, its unique and special features. The Braidwood fossil beds rate high in interest, reputation, and drawing power, not only locally and throughout this country, but they are well known to paleontologists and geologists throughout the civilized world. There is scarcely a museum of natural history that does not exhibit collections of these fossils. This area well qualifies as an outstanding region of the State of Illinois. It was the consensus that an effort should be made to preserve as much as possible of the fossil bearing area in its present condition for future use, study, research and recreation.

A proposition of this type and magnitude has many involvements that must be resolved. Steps have been taken to determine just what can be done and how it can be done. Several interested parties have been consulted and more are being contacted as the program progresses. This issue carries a letter from Dr. Gilbert Raasch, Geologist in Charge of the Educational Extension Division of the State of Ilinois, which states that organization's attitude on the subject. We need support from everyone sympathetic to our cause and will be glad to receive opinions, suggestions, and recommendations from all clubs, organizations and individuals in regard to the matter.

B. J. BABBITT, *Editor*

STATE GEOLOGICAL SURVEY DIVISION

June 18, 1952

Dr. B. J. Babbitt
Chicago, Illinois

Dear Mr. Babbitt:

Your letter of June 14 is at hand and both Dr. Leighton and I have noted with interest the action of the Board of Directors of "Earth Science Digest" in attempting to forestall the levelling of that small but important part of the strip mine piles which is of such great scientific value. We would deeply regret to see the elimination of what is unquestionably the world's most famous coal plant locality, a place which yields thousands of splendid plant fossils each year. There have been many visitors from many states and many lands who have made pilgrimages to this place of outstanding scientific significance. It was always a thrill to me, as I visited musuems about the country, in Europe, and in North Africa, to note that Illinois was represented by specimens from the strip mines of Will and Grundy counties.

It would be interesting to know how many scientists and engineers have gone on to make important contributions to science through an interest originally awakened by the Braidwood fossil beds. Closer to home, we at the Survey would deplore the loss of the irreplaceable source from which, each year, we collect some 500 plant fossil specimens for free distribution to Illinois high schools, nature clubs, scout troops, etc.

It is unfortunate that this area has not been made a public preserve and recreational area. Perhaps it is still not too late. Other states have not hesitated to set aside areas of unusual scientific interest and value, such as Geode Park in Iowa, Dinosaur National Monument in the West, the Dinosaur Track Reserve in Massachusetts, to mention only a few.

Every success to you, your organization, and the associated societies.

Yours most sincerely,
Gilbert O. Raasch
Geologist in Charge
Educational Extension Div.

Studies in Coal

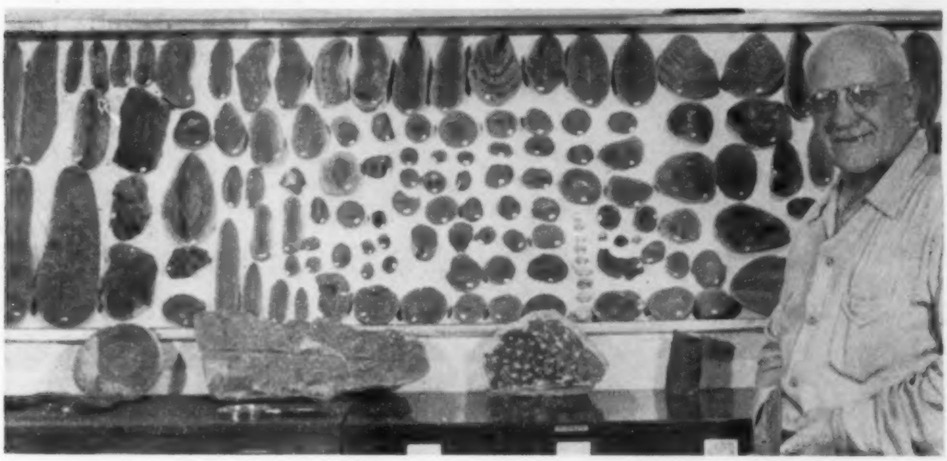
I. THE ORIGIN OF COAL

by Dr. Frank L. Fleener, Joliet, Ill.

*(The fossils in Mr. McLuckie's collection are from the Braidwood fossil beds. It is the coming destruction of these beds that is the subject of the Editorial on the preceding page.—*ED.*)*

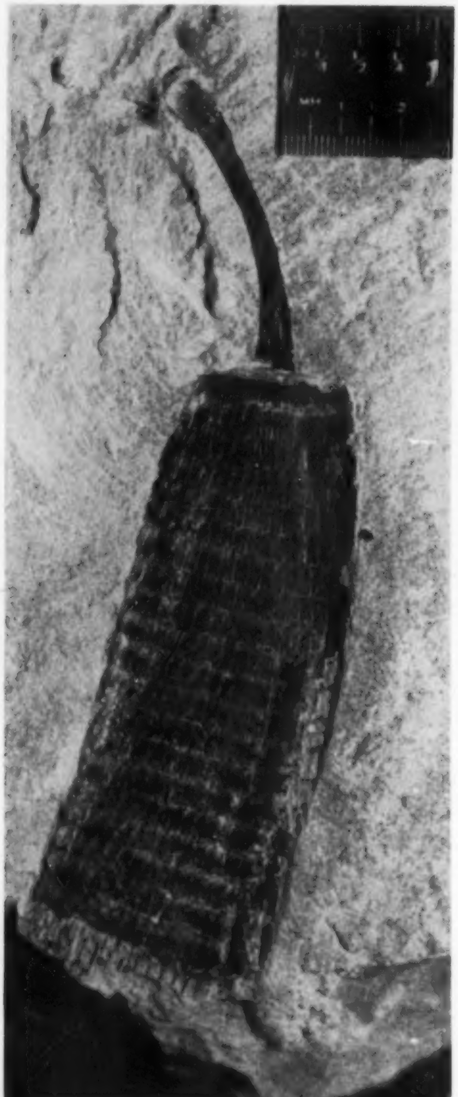
The term "coal" includes all solid carbonaceous substances, which occur in stratified form in the earth's crust and have been derived from vegetable matter so altered by natural processes that the proportion of their chief constituent, carbon, has increased to an extent sufficient to differentiate them from the original material and from peat, and which are of sufficient purity for use as fuel. (Curtis.)

Coal is obviously derived from vegetable matter, by a series of changes which are plainly traceable, even though their mechanism is not fully understood. Vegetation, peat, lignite, soft coal, anthracite, and some graphitic materials, form a series of substances which grade one into another in an unbroken line, reaching from complex organic oxidized compounds at one end to very nearly pure carbon at the other. All of these substances except the last are indefinite mixtures that vary in composition; therefore, it is impossible to write chemical equations that would properly represent their transformation. Cellulose, $C_6H_{10}O_5$, is the most important constituent of vegetable matter; it does not, however, stand alone. When it decays, it loses certain substances and undergoes changes which are hard to measure. In every swamp or bog the waters are charged more or less heavily with soluble organic matter, of which the chemical formula reactions take no account. This soluble matter is found in all waters of peat bogs and streams and is just as much a factor in the real reaction as are the gaseous products or the solid carbonaceous residues.



Photograph showing Mr. John C. McLuckie, 70 Gordon Avenue, Coal City, Illinois, with a small portion of his famous collection of coal measure fossils taken from the Wilmington Strip Mine area.

All competent investigators in the scientific world today agree that coal originated from vegetation which grew in swamps or marshy places. As the vegetation died it fell into the water where it underwent partial decay, and was buried under successive layers, either of vegetable matter like itself or else of sediment like clay. In this way it was protected from complete oxidation and from the work of erosion, which would have destroyed most of the known coal beds, had not the overlying rocks served as a shield. As these successive layers of semi-decayed matter and earth were piled up, increasing pressure took place and consequently some heat must have been generated. The parts played by heat and pressure in the final processes of consolidation of the vegetable matter cannot be fully estimated; we only know that they were very essential factors.



Rare Coal Measure fossil from the collection of Mr. John M. McLuckie, Coal City, Illinois.

There has been considerable controversy in the past as to whether coal was formed from vegetation transported to the place where the coal beds are, or whether the vegetation remained in the site where it grew. The most reasonable and widely accepted theory is that the vegetable matter grew and accumulated in the places where it is now found changed into coal, the clays, which in the great majority of cases underlie the coal seams, being without a doubt the old soils in which the vegetation thrived luxuriantly.

The evidence that the great majority of coals were formed where found may be summed up asfollows:

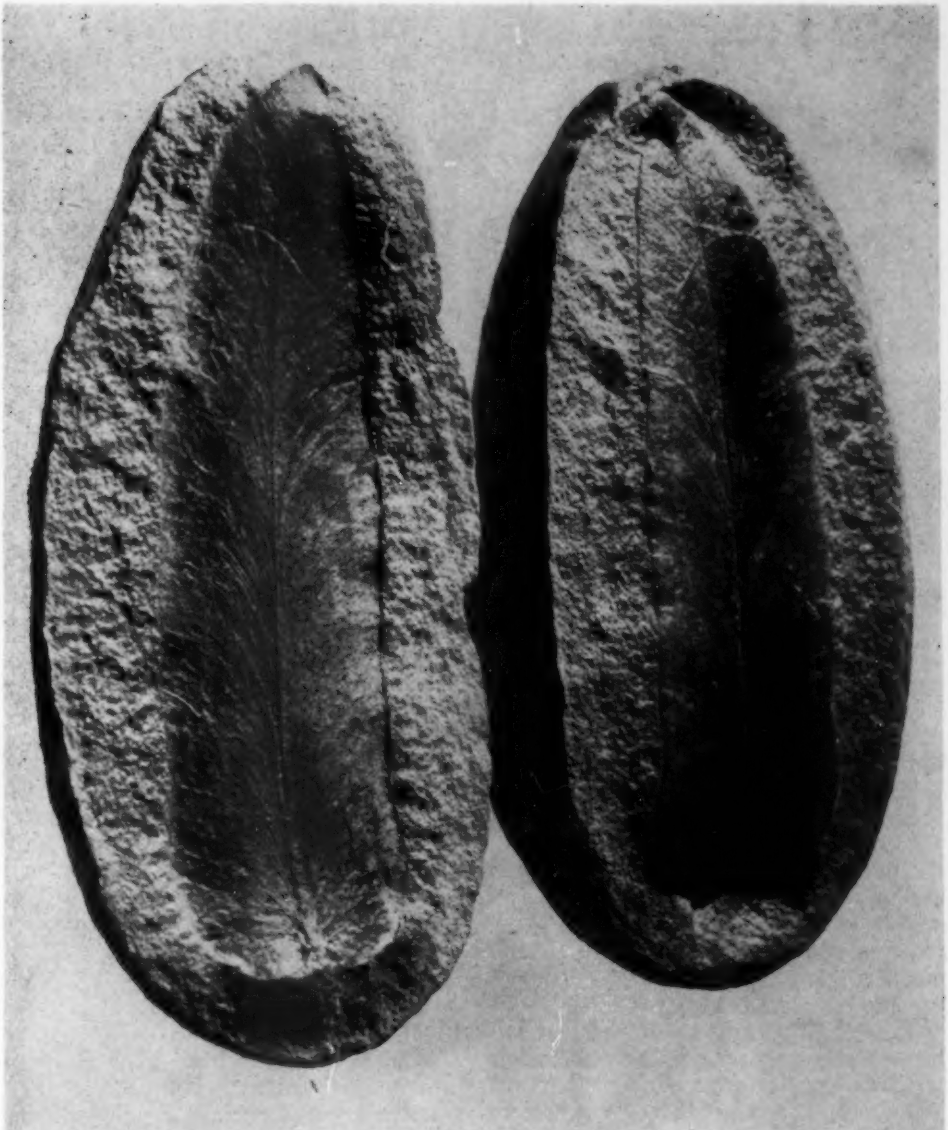
(a) The purity of many coal beds that extends over great areas; for, had the vegetable matter been washed to the place where the coal now is, it would have been mixed with much earthy material.

(b) It is also to be noted that coal seams are of uniform thickness over wide areas, which could not be the case, unless formed by uniform vegetable growth over the same area.

(c) The clay beds under the coal seams contain the remains of the roots of the plants that appear in the coal, and they are in an upright position. The fossilized trunks of trees have been found upright, penetrating the coal seam both above and below. Plant imprints in the shales above and below the coal seams show very fragile ferns imprinted in them, which could not have been moved without destruction.

(d) The vegetable matter of a coal bed is made up of a heterogeneous collection of tree trunks, small stems, leaves, and fruits of various plants, and, if this material had been swept together by streams, there would be some evidence of sorting.

From the above items of evidence we conclude that coal is formed for the most part, from vegetable matter ac-



Common Coal Measure fossil from the collection of Mr. John M. McLuckle, Coal City, Illinois.

cumulated in places where it grew.

By inference and comparison we arrive at the manner in which the vegetation grew and accumulated to form the coal beds. In the Pennsylvanian Period there were vast peneplains in the Northern Hemisphere, which had been eroded almost to sea level, covered with a luxuriant vegetation, and, as the climate was very equable and comparatively warm, this vegetation became very lush in size and closely spaced. Also, since these areas had little slope, their drainage was poor and swamps resulted, some close to the sea and some far inland; this is proven by the occurrence of marine fossils in some

(*Continued on page* 38)

They Dig Up Dirt

by Dan Davis, 5606 Clay St., Houston, Texas

Photos are by Mr. Wynn Wardell

(NOTE: This article is based on interviews with Albert J. Bonar, civil engineering instructor at the University of Houston, and explains methods used in soil mechanics instruction at the University.)

Ever hear of an "educated heel?"

Chances are you'll think of several persons who fit the description, but this term had an entirely different meaning in the civil engineering profession until recently. The "educated heel" test was a standard procedure for measuring soil strength at construction sites.

The test was simple enough. Say, fot example, that a site was marked out for a new dam or skyscraper foundation. The engineer ground his heel into the soil, and if it was firm enough to suit him, he approved the site for building!

Today, however, the engineer can predict to the letter just how much work he'll get from Old Mother Earth. Using soil mechanics, one of the newest and most promising branches of civil engineering, he is able to study the stresses and strains caused in soils by modern heavy construction. The newly-developed field has replaced most of the professional guesswork formerly used in civil engineering, and has become a standard part of engineering practices.

Virtually unheard of 25 years ago, the study of soil mechanics is now a required part of every civil engineer's college education. A typical example of a college laboratory set up to teach this new science is shown at the University of Houston College of Engineering, in Houston, Texas. Fifteen to 20 students enroll each year for the courses offered at the soil mechanics department. They work in one of the smallest yet best equipped buildings on the campus.

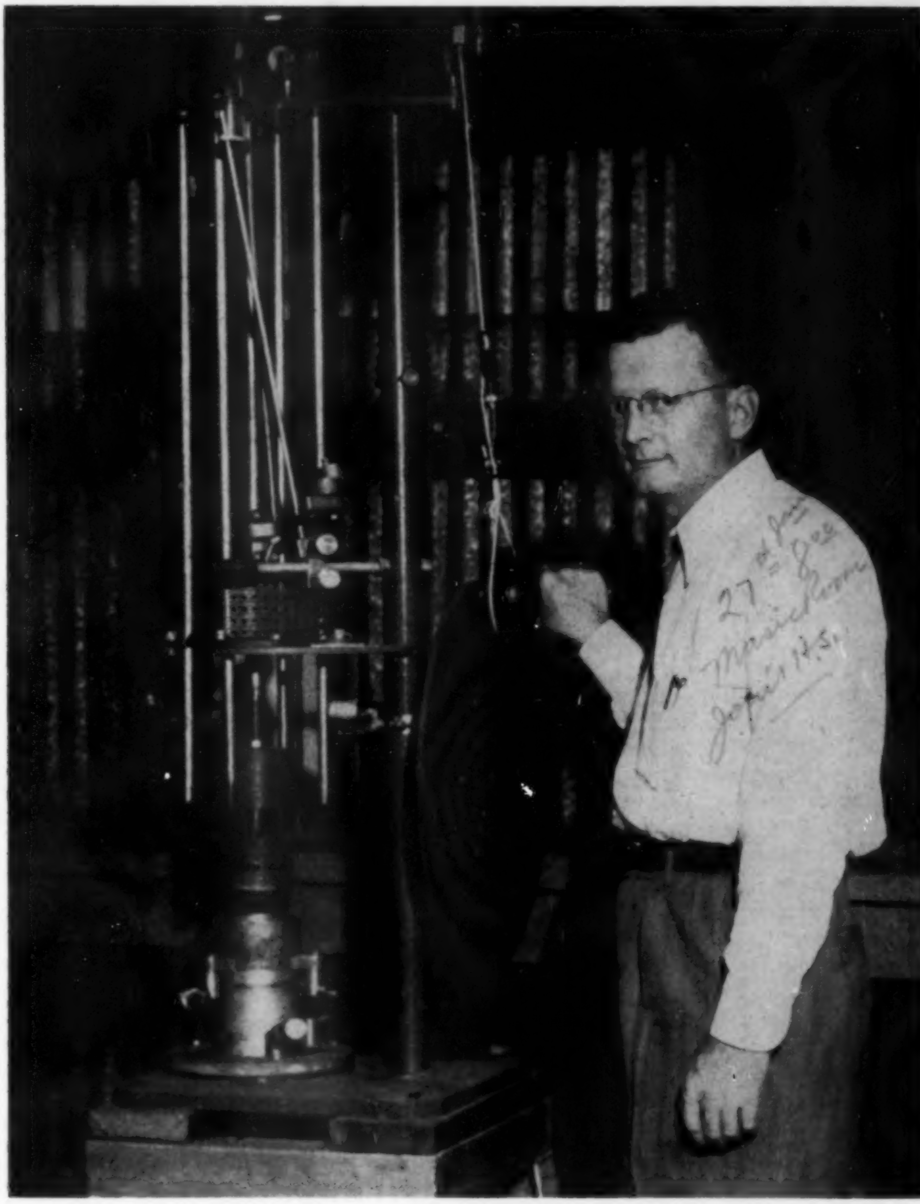
Set in a grove of trees at a remote end of the University grounds, the laboratory is housed in a three-room, corrugated-iron building, alongside the main engineering laboratories.

Almost every type of soil testing and analyzing machine in use today is contained in the tiny laboratory.

Soil mechanics courses are offered as undergraduate work at the University, a policy different from that of most other schools in the nation. This is perhaps due to the fact that when Karl Terzaghi, a brilliant German professor, brought soil mechanics into this country and its colleges, he inaugurated it as part of the graduate study program at Massachusetts Institute of Technology. Though the science was quickly recognized for its value and spread within two years to other schools, it was generally retained in the upper study brackets.

These courses began as such at the University in 1949, when the present lab consisted of one small room and very little equipment. Also in that year, Albert J. Bonar, 31-year-old graduate of Texas A. & M. College, took over as "head" of the new department. Since that time, the laboratory has been expanded to its present status and Bonar says, "I hope to begin duplicating some of the equipment soon."

Bonar believes his students will develop into better engineers if they conduct their experiments with a minimum of help. So the boys do most of the scheduled tests on their own, as well as some that aren't scheduled. As the young instructor puts it, "Many of them would toy with the dirt samples and testing machines all day long, just to see what they could make happen. But that doesn't bother me. If they want to mix up their special concoctions, I let them—as long as I know the mixture won't explode! Dirt is one of the most widely used materials in construction, either as foundations or for



Standing beside the Proctor compaction machine, Bonar rests his hand on the wheel which lifts the heavy hammer and drops it on the soil samples. The Proctor test is used in experimenting with fill dirt.

actual building materials, and the more they learn about it for themselves, the better off they'll be."

The embryo engineers begin at the bottom and find out just what soil is. "All these boys have walked on dirt all their lives, but I doubt if any of them ever stopped to consider just what it was they were walking on until now," Bonar said.

So their first problem is one of their toughest — soil classification. When the average person speaks of "soils," he has a mental picture of the black layers covering the earth's surface. Even if the engineer could confine himself to this concept, he'd have a lot of troubles in his work. But the scientific definition of soils includes everything from gravel to clay.

The red-haired instructor explained that "soils and rock are one and the same thing, anyhow. Dirt is produced through the weathering effects of sun, rain, wind, and freezing temperatures on rock layers. So, if we're using gravel in our tests, we still speak of it as a form of soil."

Some of the classification tests performed in the small building include shrinkage tests, specific gravity tests, moisture content measurements, and plastic and elastic experiments. From such experiments, the students learn how to pinpoint different soil types, and the practicing engineer can use these data to tell him whether he has worked with a type of soil before. If so, he will already know pretty well what he can expect from it and will not have to spend time with further analysis and experiment.

One classification experiment simply but effectively pointed out the fallacy of the term "quicksand." "Quicksand is not a special type at all, as some people think," Bonar explained. "It's the moisture content of any sand which determines whether it's firm or not."

To illustrate, he placed a heavy iron bar atop a glass-fronted container filled with dry sand. The bar, of course , was well supported on the surface of the sand. But by means of a perforated tube running through the bottom of the compartment, he began slowly to fill it with water. As the water seeped higher and higher through the sand, it changed the texture of the sand to a flaccid condition. When the water level reached the top of the tank, the bar upended gracefully and plunged toward the bottom.

"It's not at all true that you'll sink in quicksand." Bonar said. "You can pull yourself down, but the water-saturated sand will actually buoy you up if you remain still. Sand is one of the better foundation materials if it's confined in a cement structure or something similar ."

As a thesis for his master's degree in civil engineering, Bonar wrote a 14-page booklet about a better way of measuring soil moisture. Entitled "A Rapid Method For Determining The Moisture Content Of Soils," the booklet was bound and entered as one of Texas A. & M.'s research reports. Much to Bonar's surprise, the manual has circulated and been used in many parts of the country. "It's amazing how that thing gets around," he said.

The physical properties tests are the second group of experiments the students perform. Such basic physical qualities as rigidity, compressibility, and permeability (porous condition) are measured in these samples of dirt. Data gathered from these tests give a direct indication of the behavior of the parent soil when it is under stress.

One example of the properties test is the triaxial compression experiment, a large label which means nothing more than that the specimen is "squeezed" from three directions until it splits apart. Placed in a glass container full of pressurized water, the soil sample is confined at the bottom end. A vertical load is placed on top of the sample and slowly brought downward by an electric-powered gear arrangement, until the soil fails.

Connected to the base of the cylinder is a steel proving ring, a meter which registers the pound load on the sample when it splits. Generally, a specimen used in this experiment will split at a 45 degree angle.

Terzaghi made an outstanding contribution to the field of soil mechanics when he set forth a method of measuring the settlement of buildings due to soil compression. This method has been used to help design better foundations for all types of structures.

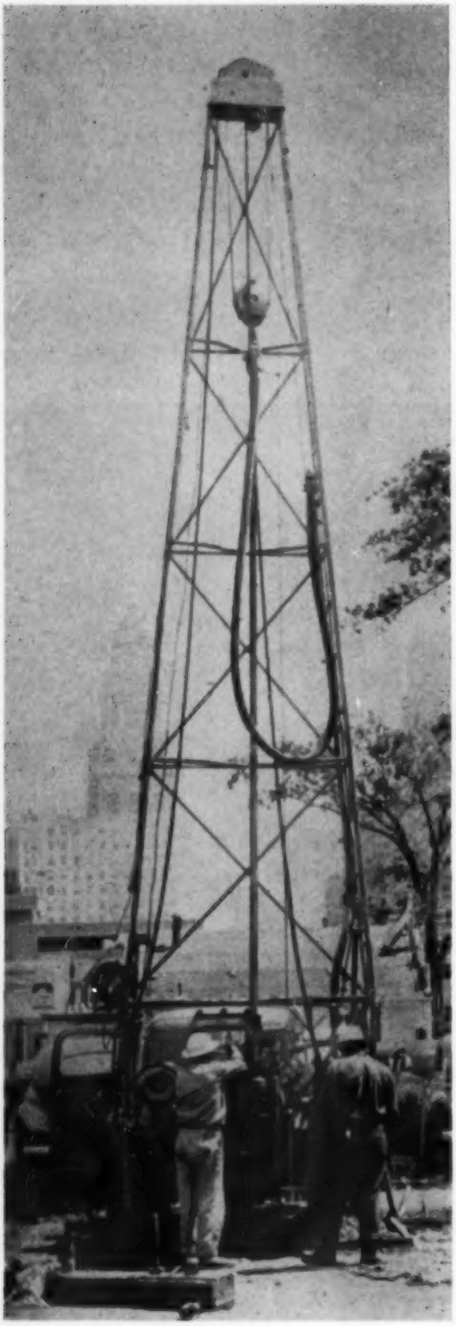
Bonar pointed out that the San Jacinto monument near Houston, one of the largest such structures in the world, had settled several inches on its base since it was completed!

The third major group of experiments are said to be "simulative." This means that if the students were actually preparing to build on soil types used in such tests, they could apply the data they get from them without any further analysis.

Perhaps the most well-known experiment of this sort is the Proctor compaction test. Consisting of a bewildering array of ropes and pulleys, the machine used in the experiment drops a hammer of a standard weight from a standard height onto a sample, thus packing it down and increasing its density.

The main purpose of the Proctor experiment is to determine how much a

Sawing one of the cylindrical samples down to size, Bonar uses the soil lathe, his newest piece of equipment. Excess dirt is trimmed off with a small wire saw as the whirring lathe spins the sample.



These men are pulling dirt samples from deep beneath the earth's surface. Attached to the end of the drill pipe is a cutting head, which carves out the cylindrical specimens and brings them to the top, relatively undisturbed.

soil used as "fill" dirt will pack down, and to tell what the most favorable moisture content of the fill soil should be. Fill dirt is used on highway and railway embankments.

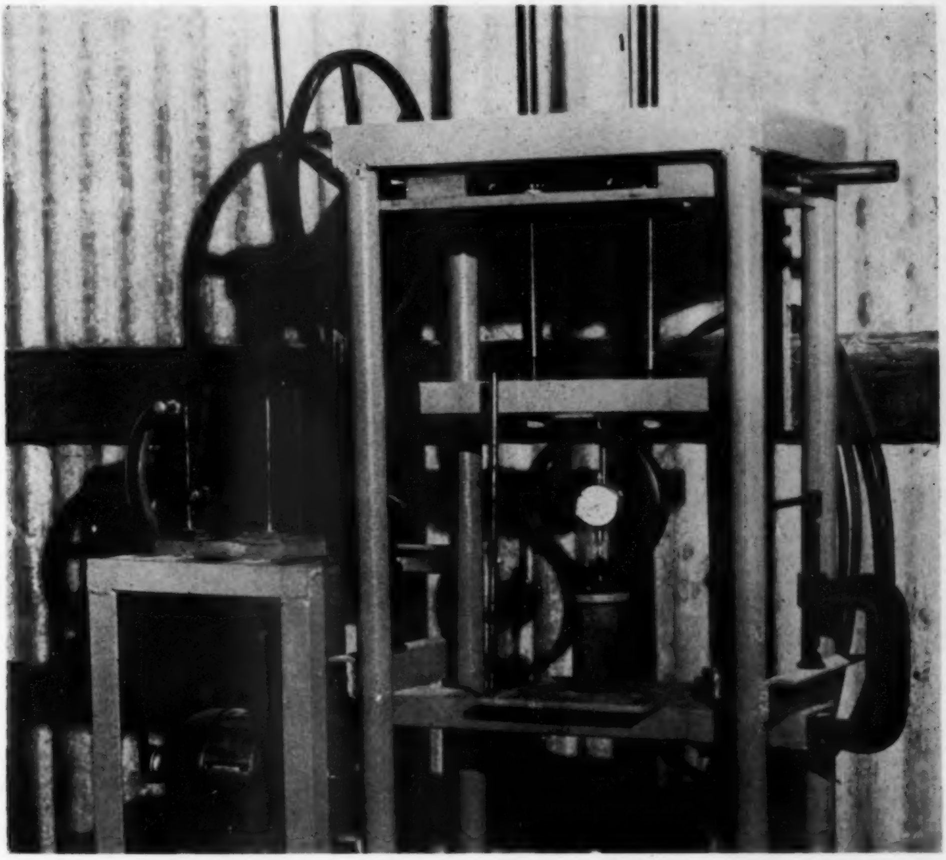
Bonar and his students attempt to answer four major questions with these tests: How are stresses distributed in any given body of soil, and how do soils act when under stress? What properties of the soil cause or prevent these stresses? How can these properties be measured?

Samples used in the laboratory are taken mostly from an odd chamber known appropriately as the "moist room." The room derives its name from a sprinkling system in the ceiling which sprays a fine curtain of water throughout the room 24 hours daily. Along the walls are wooden shelves, loaded with some 500 paraffin-sealed metal containers. In the containers, packed tightly in sawdust to help them retain as much of their natural moisture as possible, are the soil specimens. The shelves lining the wall of the dank compartment carry samples from every region of Texas.

"Even though the containers are sealed, the paraffin sealing permits a certain amount of moisture to escape every day. Keeping the air thoroughly saturated replaces these losses at once, and means the difference between a sample we can use and a dry clod," Bonar said.

Coring is the most common method of obtaining undisturbed soil samples, in which the basic structure of the soil is retained when the specimen is taken from the ground. However, the University lab is not equipped to use this method and it's too expensive to hire commercial firms to do it often.

The term "coring" is just what the name implies: driving a cutting tube into the ground and bringing back up a sample core of the dirt. Augers from 6 to 20 feet long may be used to get shallow samples, but the more costly variation uses a drilling rig similar to a well-boring apparatus.



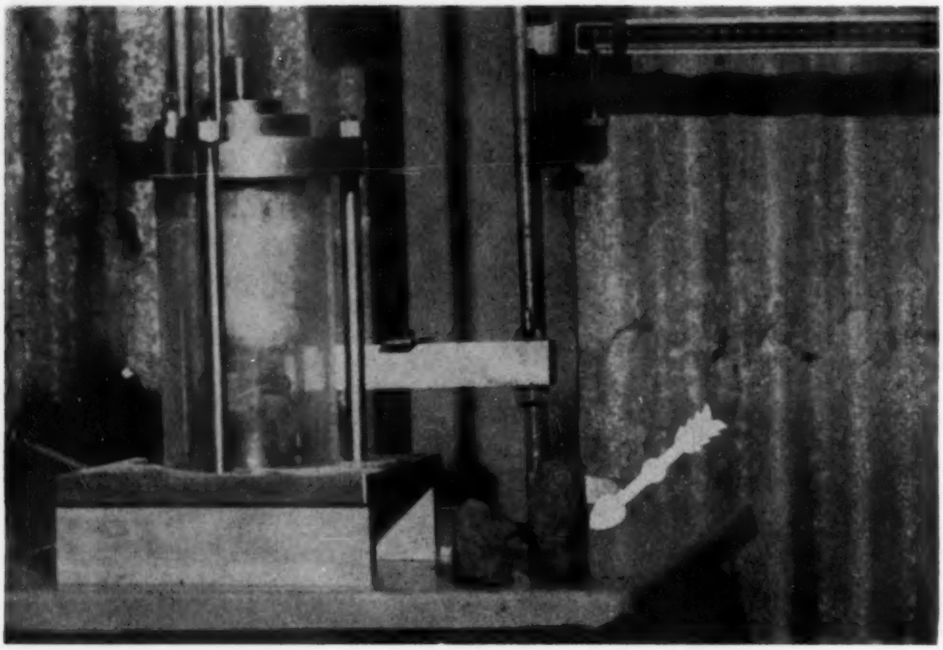
The unconfined compression test, an experiment similar to the triaxial compression test, is shown here. The specimen used in this test was showing its first signs of collapse when the electric motor was switched off. Such samples can sometimes withstand a strain of well over one hundred pounds.

Mounted on the bed of a truck, the latter type of coring rig consists of a drill stem, sectioned in 20-foot lengths, and the cutting tube which brings the samples to the surface after carving them out of the ground. After suspending the drill stem from a drilling boom, the engineers delve down into the ground, adding on more sections of pipe as they go deeper. As the drill pipe rotates, a hydraulic system forces water down into the hole to wash away the cuttings.

Bonar, smiling ruefully, said, "We don't use many samples gotten in this manner. They sometimes charge as much as $500 for a sample taken from a 100-foot hole."

Developed through several centuries of trial-and-error methods, this analysis-sampling-testing procedure now used in soil mechanics was virtually neglected until Terzaghi brought it out in its present form. Since that time, the procedure has become one of the civil engineer's main tools.

Bonar also teaches his students how to get technical data about geological formations, topography, and climatic conditions at building sites. Such data form a necessary part of the pre-construction information necessary to an engineer before he can give the go-ahead for building. For example, if an



The arrow points out the results of a triaxial compression experiment. Sheathed in a rubber membrane and placed inside the glass cylinder, the specimen is subjected to a load from the top of the apparatus, which is slowly brought downward by an electric motor and gear system. Sample shows angle along which soil generally fails.

extended structure such as a railroad is in the planning stages, topographic investigation might influence the engineer to alter the course of the road to avoid a mountain along the route which was already marked out.

In the second year at the University, the civil engineering student concentrates his studies in the "highway lab," where he learns how to plan sites for highways and railroads, and designs better subgrades for them. Very little actual experience is received by the student in this line until he graduates; most of it is "book-learnin'."

Indications for the necessity of highway study and planning were first shown as far back as the Roman Empire. These early engineers were the first to use hard surfaces to support their carriages and chariots, but instead of improving their roads when necessary, they redesigned their vehicles to fit the roads!

Soil mechanics underwent an almost incredible expansion during World War II, when military engineers had to build roads and landing strips faster, larger, and stronger than they had ever been built before. Much of this knowledge gained in wartime has been incorporated into the present college courses.

Though the friendly instructor himself was forced to dodge bullets during the war, he feels the greatest hazard he's encountered in his profession is the uninformed folk who call him on the telephone. "I get several calls a week from someone wanting me to test the soil in his backyard garden. Usually wants to know if it'll grow tomatoes!" He laughed.

Of course his work is not tied in with agriculture directly, but thanks to the soil experiments such as those Bonar and his students conduct at the University of Houston, tomorrow's highways and skyscrapers will be built on a firmer foundation.

THE NATIONAL CONVENTION AT CANON CITY, COLORADO

The fifth Annual American Federation and the Ninth Annual Rocky Mountain Federation of Mineral Societies Convention opened June 26th in Canon City, Colorado.

The official registration began Thursday morning at 10 A.M. although the preceding day, delegates had spent gaining new acquaintances and renewing old ones. The Convention officially opened with welcoming addresses by Marion Chelf, President of the Chamber of Commerce and Bob Clark, Secretary of that group. Heinz Eckert, President of Rocky Mountain Federation gave the note of welcome speech. After the opening ceremony, people went their various ways to see the numerous displays.

On the main floor were the competitive displays. Dealers, exhibitors, and mineral clubs from all over the country had entered their colorful collections of minerals and their choicest gems. There were all kinds of displays from the lovely thumb-nail exhibits to agate lampshades. It would be difficult to name all these gorgeous displays —only being there and seeing them can do them justice. Thirty-two dealers had set up attractive displays of their wares in the gym. The large groups surging around the gym testified to their popularity. A fascinating non-competitive art display was shown by Mrs. Stanley Young of Colorado Springs, Colorado. She uses rocks and minerals to paint her pictures. She covers the canvas with varnish then grinds rocks finer than the finest sand and applies it to the still damp varnish. These pictures were beautiful.

Friday morning, the Rocky Mountain Federation held their business meeting at which time they selected Houston, Texas as the meeting place for their 1953 Convention. The newly-elected officers were W. V. Vietti, of Houston, Texas, President; Domer Howard of Oklahoma City, Oklahoma, Vice-President; Kenneth C. Fry of Houston, Secretary; and Hugh Leiper of Houston, in charge of publications. Dates for the 1953 conclave will be May 2 and 3.

At the convention, Dr. Richard Pearl (left) and Junius Hayes, retiring president of the National Federation. Both played important parts.

Two outstanding lectures were given in the afternoon. Dr. Carl A. Moore, of Oklahoma University was the two o'clock speaker. He spoke on "The Canon City Embayment," which highlighted the local rock formations around Canon City, describing them from both a geological and popular point of view. His lecture was followed by Dr. H. H. Nininger of the American Meteorite Museum, one of the world's foremost authorities on meteorites, whose speech on "Out of the Sky" with pictures and samples of meteorites was most interesting and informative. His museum, at Winslow, Arizona is well known.

Members of the American Federation of Mineral Societies elected their national officers at the Saturday morning meeting. Thomas J. Scanlon of Chicago, Illinois, is the newly-elected President, succeeding Junius Hayes, of Salt Lake City, Utah. Others elected were Dorothy Craig, Los Angeles, California, Vice-President; J. Lewis Renton of Portland, Oregon, Secretary; A. L. Flagg of Phoenix, Arizona, Treasurer. San Diego, California was chosen the convention site for the 1953 conclave, set for July 17, 18, and 19.

The afternoon lectures were given by Dr. Richard M. Pearl of Colorado College and Dorothy Craig of Los Angeles, California. Dr. Pearl covered his subject "Pegmatite Dikes" in an outstanding lecture. The slides and talk by Dorothy Craig were most enjoyable. The evening's entertainment was furnished by the world-famous Koshare Indian Dancers of La Junta, Colorado, who danced the Indian tribal dances at Hickey Field. This was preceded by a Buffalo barbecue held at the High School grounds.

Left to right, top row: Dr. H. H. Nininger, Director of the American Meteorite Museum, Mr. H. Eckert, Past President, and Mr. F. C. Kessler, Past Sec.-Treas., of the Rocky Mountain Federation. Bottom row: Mr. Ken Russell, President of Marquette Geology Society and Mr. H. R. Straight, Past President of the Midwest Federation; Dr. H. L. Woodruff, President of the Eastern Federation and Dr. J. D. Willems of Chicago. (All photos by Mrs. Whitney, except last two by J. D. Willems.)

Each day various conducted tours were made to such places as Royal Gorge, Portland Cement plant, Mollie Kathleen gold mine in the Cripple Creek area, and Wet Mountain valley. However, to everyone's disappointment, there were no scheduled collecting trips during the convention. The Columbine Gem and Mineral Society of Salida, Colorado invited the delegates to a two-day field trip following the Convention, the first day a sight-seeing trip and the second, a field trip with collecting. Unfortunately many delegates could not stay that much longer.

Sunday was the closing day so everyone had to see all the displays they had missed and do last minute visiting and swapping. The swapping table in the basement proved to be quite a success. On Sunday, only a little remained to be traded. Everyone seemed pleased with their deals. In the afternoon, A. Look, of Grand Junction, Colorado gave the two o'clock speech on "In My Back Yard," followed by a lecture with slides and transparencies by North West Federation President J. Lewis Renton.

The Convention closed with a banquet given by the American Federation of Minerological Societies. The newly-elected officers were introduced to the group. Junius Hayes of Utah University, retiring President of the American Federation was the principal speaker.

—MRS. LOUISE BISH

THE ANNUAL MEETING OF THE MIDWEST CONFERENCE

by Loretta Koppen, Publicity Chairman

Approximately 3000 people visited the mineral and geology displays at the 12th annual convention of the Midwest Federation of Mineralogical and Geological Societies held at Macalester College in St. Paul, Minn., on July 1, 2 and 3.

The program included displays of minerals, lapidary work and geological items by local societies as well as by other clubs and individuals throughout the midwest. Commercial dealers in minerals and lapidary equipment were on hand to supply specimens and cutting material.

At the convention, left to right (top): Mr. Wm. Bingham, Chairman of Convention; Mr. D. A. Thomas; Mrs. L. Koppen; Mr. S. T. Perry, Retiring President. Bottom row: Mr. W. H. Allaway, new President of Midwest Federation, and Mr. Art Hedlund, President of Minnesota Mineral Club.

There were lectures by D. W. S. Glock, chairman of the Macalester geology department, on "Geology of the Twin Cities Area," Dr. George M. Schwartz, head of the Minnesota Geological Survey and a member of the University of Minnesota faculty, on "Minnesota Iron Ore," and Kenneth Russell, president of Marquette Geologists Association on "Stone Carvings."

Several interesting field trips were arranged. One of the most outstanding trips was to the famous Taylors Falls pothole region led by Dr. George A. Thiel, chairman of the University of Minnesota Geology Department. The trip to the Twin City Brick Co's. quarry also was definitely interesting. Hats off to the fine young student guide and mentor—Peter Miller.

Mr. W. H. Allaway of Downers Grove, Ill. was elected president; Mr. A. Hedley of St. Louis, Mo., vice president; Mrs. Oriol Grand-Girard of Chicago, Ill., secretary; Miss Marjory Scanlon of Chicago, Ill., treasurer; Mr. Ben H. Wilson of Joliet, Ill., historian. The St. Louis Mineral and Gem Society of St. Louis, Mo. will be host to the 1953 Midwest convention.

Minerals of the Eastern Federation

by H. L. Woodruff
President, Eastern Federation of Mineralogical and Lapidary Societies

Since our Eastern Federation Convention will be held in Newark, New Jersey this year, it is only natural that in writing of minerals of the Eastern Federation, we should select New Jersey. Fortunately, for the student and collector, the State offers a great variety of types which are not only unusual for their beauty, but also for the unique manner in which some of them were formed. Museums are essential tools in the study and pursuit of knowledge of minerals by the students, collectors and mineralogists. They have added attraction from the fact that most of them house specimens from mineral deposits that have a great deal of historical and economic significance, which have helped shape the nation's destiny since the date of the earliest settlers.

These Museums owe their existence to the untiring efforts of many private individuals, all of whom have gained knowledge and profitable data from their endeavors; also, a great deal of pleasure in presenting their collections to Museums or other public institutions for the benefit of posterity. A man who is outstanding for a gift of this kind as well as for his astonishing range of interest in the field of Natural Science, was Dr. W. S. Disbrou of Newark, New Jersey. His collection of minerals and geological specimens alone totaled more than 30,800, the exhibition of which became an important factor in the origin, growth and development of the Newark Museum. Many similar workers have left a wonderful legacy of learning to succeeding generations.

To cover the entire list of minerals from New Jersey would consume many pages, and an unlimited amount of time, but perhaps the visitor to the Convention at Newark would be interested to know about a few of the outstanding localities and the minerals they produce. Franklin, in Sussex County is such a locality, and should interest the student, geologist, historian, economist and mineralogist alike, for it is fraught with interesting lore. The deposits of zinc ores—willemite, a zinc silicate; zincite, an oxide of zinc; and franklinite, an oxide of zinc, iron and manganese—are prominent in this area. Added to this, is a long list of associated minerals which occur in no other locality in the world. The early history of the working of these deposits, makes very interesting reading. About 1640, Dutch settlers were mining copper ore in the Hudson Valley. They were looking for new copper deposits, and evidently stumbled upon these Red Zinc Oxide deposits, and mistook them for copper ore. Lord Stirling came into possession of the Sterling Hill property as an inheritance from his ancestors in 1770, and evidently made the same mistake as did the Dutch; in 1772 he shipped a number of tons of it to England, expecting that copper would be smelted from it. No copper was ever smelted from it, and the English did not recognize it as a zinc ore. The Lord also made the mistake of attempting to use the franklinite he found on his estate as an iron ore. The smelting of this failed, on account of the presence of zinc and manganese.

The American Revolutionary War diverted Lord Stirling's mining activities, and he distinguished himself against the British, and finally wound up as a Major General, as a reward for his heroism. It was not until Dr. Samuel Fowler came into possession of the property that the composition and nature of the zincite and franklinite became known by a number of prominent geologists and chemists, largely through the efforts of Dr. Fowler and his son Col. Samuel Fowler, who later inherited the property. Several attempts were made to commercialize the ores, but without success. However, Dr. Fowler did succeed in producing white zinc oxide pigment directly from zincite, which ground in oil, made paint.

In 1838 a small amount of metallic zinc was produced and was used to make brass. Col. Fowler finally sold his holdings.

Commercial utilization of the ores did not take place until about 1850 when the New Jersey Zinc Company took charge of the property, and their economic importance was developed. New methods of mining have been developed, and many new minerals have been discovered.

Nothing in this world is static, and the formation of the Franklin District is an excellent example of this statement. Much has been written about the manner in which these minerals formed. It is extremely difficult to formulate an "ironclad" hypothesis for their origin, on account of the complex rock structure with which they are associated. These deposits are associated with some of the most ancient rocks of the earth, and thought to be approximately two billion years old, called Pre Cambrian. Some of the minerals that are associated with the New Jersey zinc ores are garnet, variety andradite; sussexite; rhodonite, variety fowlerite; scapolite (wernerite); calamine (hemimorphite).

The Franklin minerals have another distinctive property, that of fluorescence, for when they are exposed to ultra-violet light of the proper wave length, they emit visible light, brilliant in color. Some specimens are readily identified by this method, and many collectors make very colorful and effective displays of fluorescent minerals. Because some of these minerals may have a rather drab appearance in ordinary daylight, the effect is breath-taking to watch them leap into gorgeous brilliant color patterns when exposed to ultra-violet light. Some of these minerals also display varying degrees of phosphorescence, emitting visible light after the ultra-violet light source has been removed. Among the more prominent minerals that exhibit fluorescence are calcite, a calcium carbonate that fluoresces a vivid red. Willemite shows a brilliant green, and calcium larsenite, which fluoresces bright yellow. The Franklin deposits are noted for their fluorescent minerals.

Magnetite, an ore of iron is also found in New Jersey and is mined in commercial quantities. It also occurs in the Pre-Cambrian gneisses and in the same limestone which contains the zinc ore deposits. It is mostly found disseminated as small grains and bunches in the gneiss and is concentrated in bodies having the general shape of pods or lenses. The deposits are thought to have had several enrichments at different times and from different sources, until it reached the degree in which they are found today. Most ore samples of New Jersey magnetite are unspectacular, and not unusually interesting. The deposits have been worked since before the Revolution. Talc and serpentine have been mined in New Jersey, and rather large deposits were worked in the vicinity of Phillipsburg. Usually, talc is a soft opaque white substance, and serpentine is much harder, and ranges in color from white to a pleasing green. Some is almost black, with white streaks that meander through it, giving it the appearance of a serpent, whence its name of serpentine. This type, when cut into slabs is called serpentine marble. A variety that is intermingled with calcite is known as Verd Antique, and has been used for decorative purposes for hundreds of years. Copper is a New Jersey mineral, and has been mined during Colonial and earlier times. Much has been written about New Jersey copper, and much more money has been spent in mining operations than has ever been recovered by the sale of the copper, as most of the deposits are of low grade ore. The old Schuyler property is probably one of the outstanding mines which was located near North Arlington. Discovery of copper on the property took place around 1712, and has been described as the first copper mine in America. Water filled shafts and tunnels, plus exhaustion of profitable ore, finally resulted in the complete abandonment of the mine.

Elias Boudinot, who later became President of the Continental Congress, also became interested in copper mining in New Jersey. He leased mineral rights on the farm of one Philip French near New Brunswick, and mined copper until water seepage forced him to cease operation. A century later, Thomas A. Edison tried his hand at copper, becoming interested in an old copper mine near Menlo Park, but found that the low grade of the ore would not pay the mining costs. Chalcocite, a sulphide of copper, was the kind of ore most abundant, and therefore, the most important mineral taken from the mines.

In the discussion of New Jersey copper mining, mention should be made of the old Pahaquarry diggings, located on the northwest side of Kittatinny Mountain above the Delaware, six miles southwest of Flatbrookville, most likely the oldest copper mine in the state.

Zeolites are among the most interesting and the most unusual minerals from New Jersey. These hydrated silicates, together with their related silicates, sulphates and carbonate, represent a series of natural chemical reactions, which took place at the time when the Watchung Mountains and the Palisades were formed. Much study has been directed to the manner in which the Zeolites originated, and to the reconstruction of the proper formational sequences of these associated minerals. So that today, virtually every link in the chain of events is well established.

The minerals considered to be true zeolites include heulandite, stilbite, laumonite, chabazite, analcite, natrolite, scolecite, mordenite, thomsonite, gmelinite and mesolite. Only the first six mentioned are relatively abundant in New Jersey. Chemically, they are very similar, being hydrous aluminum silicates of sodium or calcium, but physically, they are quite different. Their distinctive colors, structures and lusters make the more common ones comparatively easy to identify, and these properties, together with the fact that they have frequently been found in large masses, make them highly prized among collectors. Apophyllite, pectolite, prehnite and datolite, also hydrous silicates are not classed as zeolites, even though they have a similar origin. Closely associated with the zeolites, they, too, have often been found in large masses, usually along with one or more of the zeolites, and because of their equally distinctive features, they are valued additions to many mineral collections. Quartz and calcite of various types are also abundant products found in the zeolite rocks. Further, processes of alteration that are still active have been responsible for the formation of less abundant minerals like azurite, chrysocolla, malachite, limonite, gypsum, and thaumasite.

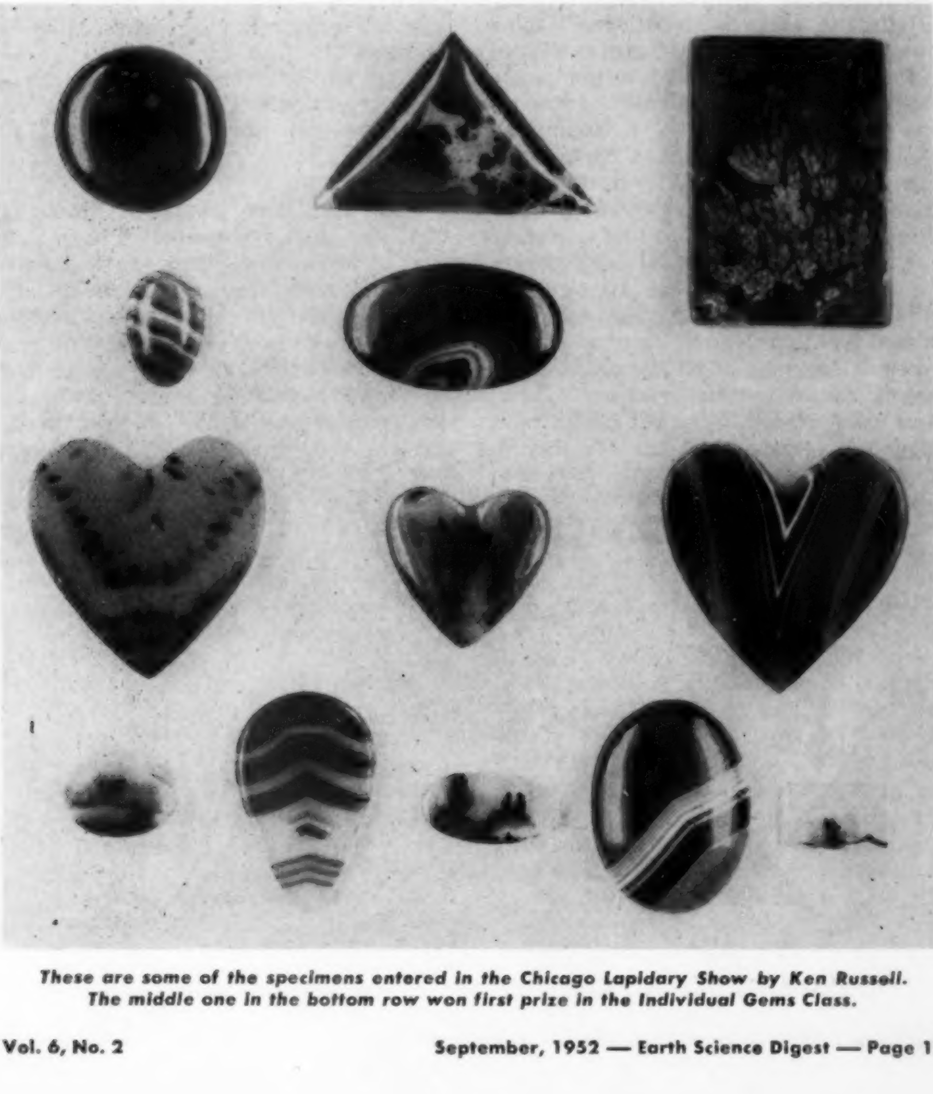
A great many zeolites and their associated minerals found in New Jersey come from an area stretching roughly from Paterson to Montclair, along the First Watchung Mountain where trap rock quarrying operations that have been carried on for many years are instrumental in bringing to light new deposits of the minerals. The locality is famous for its large, colorful specimens, and is known to collectors throughout the world. There are other zeolite localities in the Triassic trap rocks of the State, those in the vicinity of Jersey City being perhaps the best known. But no crystal cavities have been found associated with these minerals, which fact implies that a different set of geologic conditions must have existed during their formation.

CHICAGO LAPIDARY SHOW A SUCCESS

by KEN RUSSELL, President, Marquette Geologists Association

The second annual Chicago Lapidary Club Show held at Grand Crossing Park on May 17, 18, brought together some of the most outstanding exhibits of jewelry and lapidary work in the Chicago area. There were 20 cases of exhibits covering 16 classifications which were judged on a competitive basis and trophies were awarded to first place winners. A Best-of-Show trophy was awarded to the most outstanding exhibit.

There were 224 entries listed representing The Chicago Lapidary Club, The Earth Science Club of Northern Illinois, Chicago Rocks and Mineral Society, The Marquette Geologists Association, and all the Chicago Park District lapidary classes. It was the close cooperation of all the above mentioned parties that made the show one of the biggest and best ever to be held in the Midwest, and next year's show promises to be even better. (*to page* 38)



These are some of the specimens entered in the Chicago Lapidary Show by Ken Russell. The middle one in the bottom row won first prize in the Individual Gems Class.

Indiana Holiday

by C. R. Hoffman

Vice President, Earth Science Club of Northern Illinois, Riverside, Ill.

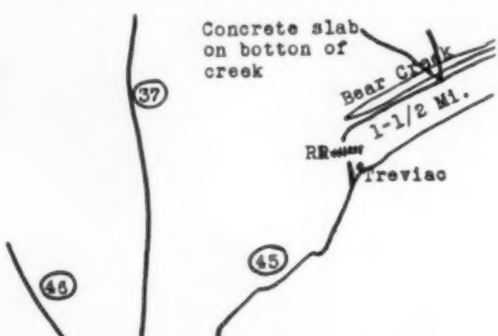
For our last week's vacation of 1951, we decided to visit the State Parks in Indiana. The date selected was the middle of October, when the colors of the woods would be turning and fall pictures would be at their best. In addition to the film required for the vacation trip, we needed some information on where one could find "what in rocks" in Indiana. In order to become better acquainted with "what in rocks" could be found in Indiana, Dorothy (Mrs. Hoffman) along with Mildred Babbitt, went to the Chicago Natural History Museum and spent a day in the geology section. Loaded with all information as to "what" could be found and "where to go" we started for a week's vacation in Indiana. The first "where" was Crawfordsville, Indiana, and "what" was a very long list under one general heading "fossils." We arrived at Crawfordsville about 10 o'clock in the morning and began to ask about fossil locations. Zero success. No one seemed to know anything about fossils being found in this territory. Everyone knew something about fossils being found at some other spot. We then decided that the geology department of the University at Bloomington, Indiana, was going to be our next stop. In Bloomington we met Mr. John Patton, Head of the Minerals Section of the Indiana Geological Survey. Mr. Patton proved to be a rock hound of the first order. He knew where "what" was found and "how to get there." In the latter case he could give detailed directions as to side roads to take, where to park your car, etc. We found him a regular gold mine of information on Indiana.

Here are four trips that we took at his suggestion with directions for you when you too have an "Indiana Holiday."

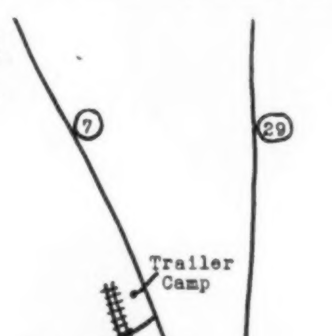
1. *GEODES*

Take Ind. Hwy. 45 out of Bloomington, east to the town of Trevlac. As you enter the town from the west, turn left and cross the railroad track on a gravel road. Go up this road about 1½ miles. Bear Creek borders the road and geodes are found in the stream bed.

We had no sooner parked our car in a side road and started to look in the stream bed when a young gentleman



1. Where geodes were found.



2. Where fossils were found.

invited us to his farm home just one block away to see his collection. The gentleman and his charming wife took us through their rock garden and their home. Beautiful geodes with crystals, geodes with chalcedony, geodes that were fluorescent, and more geodes of all sorts and shapes and sizes were everywhere. One beautiful specimen in the rock garden weighing about 400 pounds was dug out by the mules when he was plowing. In our discussion it developed that this young couple had been 42 years gathering the collection and they weren't done yet. They also had boxes of Indian artifacts and one perfect stone axe that any collector would envy. Our visit had delayed our collecting and it was almost dark before we left the stream bed. We did find some geodes and also four nodules that were obvious sedimentary calcite replacements of brachiopods. One nodule was almost a perfect replacement while the other three showed damage to the specimen during the replacement process.

2. *FOSSILS*

Take Ind. Hwy. 7 north out of Madison, Indiana. About two miles north of the town, the road climbs along a rock ledge and under an over-hanging coral rock. Just beyond the top of the hill is the Madison State Hospital. About one block beyond the hospital at the left of the road is a trailer camp where we secured permission to park our car. The Pennsylvania Railroad borders the trailer camp. We walked down the railroad track toward the town of Madison and entered a rock cut. The side walls of the cut are approximately 100 feet high. As the height of the cut began to diminish, we saw rock ledges between the layers of shale. Fossils and coral were found in these ledges. If you visit this railroad cut on a hot day it is suggested that you look out for copperhead snakes as the natives say the snakes frequent this particular railroad cut.

3. *BRACHIOPODS AND CORAL*

Take U. S. Hwy. 31E northwest from Jeffersonville. About a mile north of where Ind. Hwy. 62 intersects U. S. Hwy. 31E there is a gravel road toward the east, which goes into the T. J. Atkins quarry. In this quarry, brachiopods were found in the red clay which was being stripped off the limestone. In the bottom of the quarry along the wall near the floor were thin layers of shale. Coral was found in this shale.

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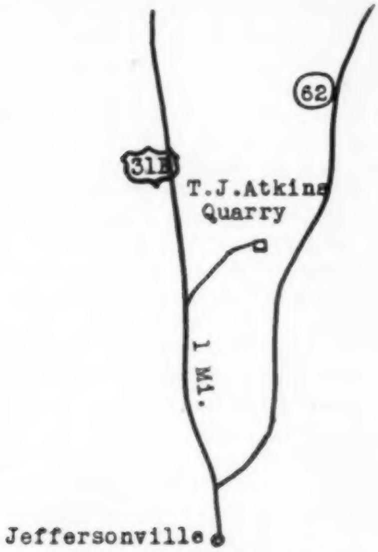
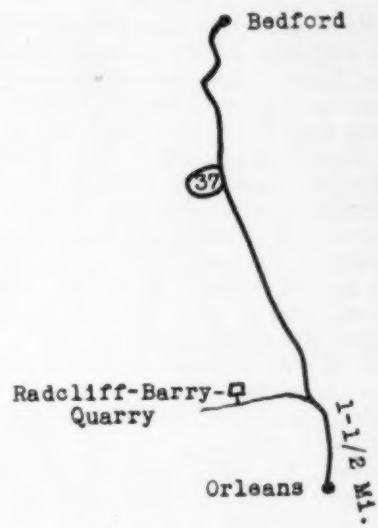


3. Where brachiopods were found.



4. Where oolite was found.

COLLECTING ON THE NIAGARA FRONTIER

by JOHN D. SARGENT, Curator of Geology, Buffalo Museum of Science

Although representing a rather poor mineral collecting area, the Niagara Frontier offers an opportunity for some of the world's best fossil collecting. The Niagara Frontier area includes the Niagara Peninsula of Ontario, Canada and all of Western New York, west of the Genesee River.

Minerals

No mineral collection should be without examples of the Lockport minerals. The Silurian Lockport dolomite is exposed at the top of the Niagara escarpment stretching from Rochester, N.Y., to Hamilton, Ontario. This dolomite contains vugs lined with pink curved dolomite crystals, dogtooth spar calcite, selenite and granular gypsum, celestite, anhydrite, and sphalerite. Less common are galena, fluorite, malachite, azurite, pyrite, quartz, and chalcopyrite. Most highly prized are the large clear cleavages of selenite containing well formed crystals of the above mentioned minerals or large fluid inclusions containing a bubble making a natural level. At present, the best localities for these minerals are the crushed stone quarries at Gasport and Lockport, the Ontario Hydroelectric project at Queenston, Ontario, and the stone quarry at St. David's, Ontario. Elsewhere in the Niagara Frontier occasional specimens of calcite, marcasite, barite, and siderite are to be found in concretions. Chert is common in the Onondaga ls. Most of these minerals can be obtained by writing to the author.

Fossils

The Niagara Frontier is really a fossil collector's paradise. A complete stratigraphic column from Lower Silurian to Upper Devonian inclusive, is exposed with the exception of the Lower Devonian, which is absent. All of the type sections for the Silurian lie within the Niagara Frontier. They are Medinan, Niagaran, and Cuyugan. From the Medinan sandstones exposed in the Niagara Gorge and at the base of the Niagara Escarpment, good specimens of Lingula, Arthrophycus, and ripple marks can easily be obtained. From the Niagaran Rochester shale exposed in the Niagara Gorge, Lockport Gulf, and the Gasport outlet to old Lake Tonawanda, a great variety of fossils can be found. These include graptolites, both tabulate and tetracorals, crinoid and cystoid calyxes, bryozoans, brachiopods, molluscs, ostracods and trilobites. From the Cuyugan Bertie Waterlime to the south from Hagersville, Ont. to Batavia, N. Y. come the highly prized eurypterids. Unfortunately, no active quarrying is being conducted in the Bertie Waterlime at the present time. There are, however, many quarries in the overlying Devonian Onondaga ls. from which good specimens of bryozoans, brachiopods, corals, cephalopods, and trilobites can be obtained, but with more difficulty than in the softer shales. The middle Devonion Hamilton Group offers opportunities for fossil collecting that stagger the imagination. For in these beds lie literally millions of unbroken, uncrushed, whole fossils that can be plucked from the soft shale with the fingers or at very most, a light tap with a pick or a little prying with a knife. The brachiopods and corals are so abundant that local collectors seldom bother to pick them up. Every Phylum and most of the Classes are represented in the fossil remains of the Hamilton Group. And where are these fabulous collecting grounds? They extend in an arc from Grabau's famous 18-Mile Creek locality on Lake Erie to a point just south of Buffalo, and then eastward to a point north of Mount Morris on the Genesee River. These same beds continue eastward through the Finger Lakes to the Syracuse area. Noteworthy outcrops in Western New York include 18-Mile Creek, Rush Creek, Cazenovia Creek, Scajaquada Creek, Buffalo Creek, Spring Creek, Tonawanda Creek and many others. Of special interest in this area are the little encrusting forms

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Stone Carving

by Ken Russell
President, Marquette Geologists Association

Lapidary work has too much variety to ever become boring. Unlike many hobbies, it leads into several closely related fields where new challenges to the skill of the hobbyist may be found. It gives an outlet to mechanical ability and to the desire to create something of beauty, and the amateur has the opportunity to work out new methods and new equipment which, in many instances, have been later adopted by professional cutters.

These related fields which the cabochon cutter will find inviting include study of minerals and of their locations, field trips to find gem stones, jewelry craft to make settings for stones, facet cutting, sphere cutting, the making of book ends, lamp bases and other large objects of stone, and carving.

Of all these interests, carving is certainly the least explored by the amateur. There are several reasons for this, among them lack of self confidence in artistic ability, unfamiliarity with the equipment needed, and a scarcity of literature on the subject.

Most of these have no real foundation. Excellent carving can be done by a person who has no artistic or design ability at all, and the equipment needed for most work costs as little as $12, although the average outfit will cost about $40.

The essential items of equipment are:

1. A small flexible shaft outfit with as small a head as can be obtained.

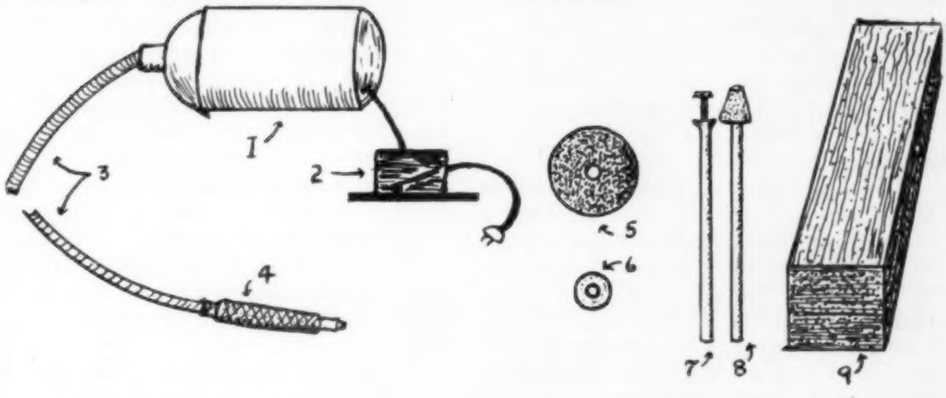
2. A rheostat to control the speed of the tool on various operations.

3. Small silicon carbide wheels of coarse to fine grit, and at least one rubber bonded wheel to remove scratches and a felt polishing wheel. Such wheels cost as little as $1 a dozen. A metal bonded diamond wheel used by dentists is available at about $6 but is not practical.

4. A shank for holding the various wheels.

5. A respirator to keep fine stone dust out of the lungs. This may be a regular respirator or a damp cloth over the nose and mouth will serve.

6. Calipers for taking measurements in the round.



Some of the equipment that may be used in carving.
1- Motor. 2- Rheostat. 3- Flexible Shaft. 4- Shaft Head.
5- Silicon Carbide Wheel. 6- Rubber-Bond Silicon Wheel.
7- Shank for Interchange of Wheels. 8- Tapered Wheel.
9- Silicon Carbide Truing Block.

7. A silicon carbide truing stick. An old grinding wheel will do. This is used to true up the small wheels whenever they are changed, as they are slightly off center until trued up. This is done by running the motor at high speed and holding the wheel against the stick. The stick will also be useful to shape the wheels to any special contour needed.

8. Aluminum pencil for marking the stone.

Material to be carved should be stone that is free of fractures and not subject to easy cleavage. Some of the better materials are Brazilian quartz, howlite, thulite, jade and obsidian. Sapphire and even diamond have been carved and engraved but they are too hard for the amateur.

Howlite is a soft, white stone mottled with white, a borax mineral. It takes a fair polish and can be bought for as little as 50 cents a pound. Thulite is pink and is often mottled with green. It is coarse but takes a good polish. Jade is usually green or black, is harder than howlite and thulite, and is often difficult to polish. Obsidian is a natural glass and, like glass, it chips easily, but it is cheap, comes in a number of colors, is available in pieces of any size, and takes an excellent polish.

Sometimes the color and pattern of the stone can be chosen to fit the object to be carved. For instance, howlite is perfect for a wire-haired terrier or a horse, and black jade is right for a scottie.

The beginner should choose an object that does not call for too detailed a carving. Outline the object on a piece of paper, using paper ruled into squares if necessary to get the proportions right. Cut out the outline and transfer it to a block of stone by drawing around the paper model with the aluminum pencil. The stone block should be cut slightly larger in three dimensions than the model.

Then with a coarse wheel cut away the material outside the outline, being careful to cut at a 90 degree angle to the outline. Then with a less coarse wheel cut away more material, being careful not to over cut, by taking frequent measurements with the calipers. Work the figure down by cestions, leaving the finest detail work for the last, as it is much easier to get proportions right if the shape is seen to grow out of the rough block gradually. The trick of keeping both sides of such a figure as a horse or dog in balance is readily learned.

When the figure is properly shaped, scratches are taken out with the rubber bonded wheel, and then a small felt buff moistened with tin oxide slurry gives the final polish.

Barring accidents, a carving 2 inches by 2 inches can be finished in 12 to 14 hours. It is possible to turn out a good many cabochons in that same time, but the carving will give equal and probably more satisfaction to its maker, and it will stand out in his cabinet as no cabochon could hope to do.

PIPING WATER TO MY SANDER

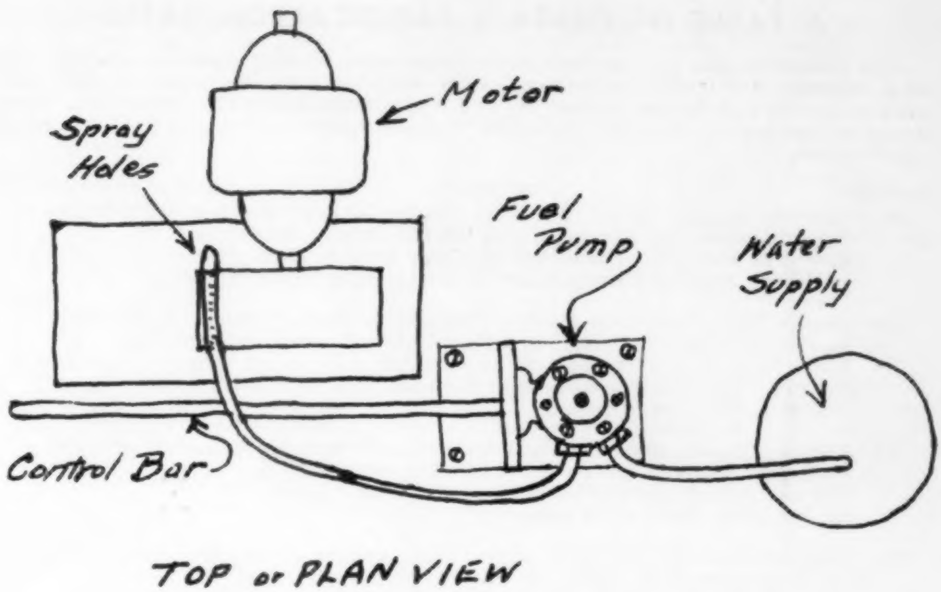
by RAY LULLING

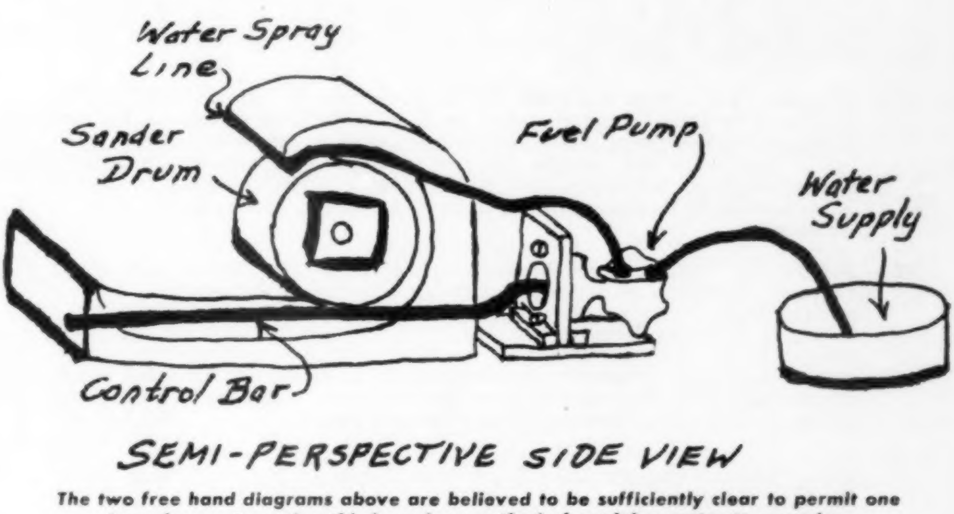
175 N. Avon St., St. Paul, Minn.

Some time ago, I piped the city water supply to my drum sanders as a spray system for wetting the sanding cloth. This was quite unsatisfactory, as the continuous spray was not what I wanted and turning a valve on and off every few seconds is a nuisance. I have worked out a method to solve the problem of applying water to drum sanders, without a steady stream. The sander can then be used as wet or as dry as the operator wishes.

I purchased a car fuel pump from an Auto Supply store for $1.98, also some short pieces of copper tubing (gas line).

To the fuel pump lever, I welded an extension about 12 inches long. The pump was then mounted on a stand behind the sanding arbor, with the lever running thru to project thru to the front of the arbor. Next I took a piece of the copper tubing and pinched one end to seal it, then drilled a series of small holes (No. 60) along the tube





The two free hand diagrams above are believed to be sufficiently clear to permit one to make a setup using this ingenious method of applying water to a sander.

for about 3 inches. I then fastened this end of the tube to the wheel guard over the wheel so that a tiny jet of water emits from each hole. There are about 8 to 10 holes in line in the tube so there will be little streams of water across the whole surface of the wheel face. The other end of this tube goes to the outlet of the fuel pump.

Another tube is inserted in the intake of the pump and runs to a dish or a tank of water.

Now when I stand in front of the wheel and sand a stone, all I have to do is bump the lever a little with my hand or wrist and the wheel is wet.

A TABLE OF CERTAIN RADIOCARBON DATES

The following table gives certain radiocarbon dates, in most cases also the dates by other methods. It is interesting to compare the dates given by other methods with those assigned by the radiocarbon method. By such comparative tables an evaluation of ideas, things, or methods can be made, but more than one specific example is needed to make a fair valuation.

Sample	*Description*	*Age (years)* C_{14}
260	Ipiutak, Alaska. Wood from the Ipiutak site at Deering, Seward Peninsula, Alaska. Third level in debris. Estimated date 0 to 500 A.D. Excavated by Helge Larsen, 1949. Submitted by Froelich Rainey, Univ. Museum, Univ. Penn.	973 ± 170
103	Broken Flute Cave, New Mexico. Douglas fir wood excavated by Earl Morris in 1931 from Red Rock Valley, Room 6, Broken Flute Cave. Tree ring date: Inner ring 530 A.D.; outer ring 623 A.D. Submitted by T. L. Smiley, Laboratory of Tree Ring Analysis, Univ. of Arizona.	973 ± 200 1070 ± 100 Av. 1042 ± 80
62	Ptolemy, Egypt. Wood from mummiform coffin from Egyptian Ptolemaic period. Known age 2280 Yrs. according to John Wilson. Submitted by John Wilson and Warson Boyes, Oriental Institute, Univ. of Chicago.	2190 ± 450
152	Hopewell, Ill. Wood from wood and bark capping, lower edge of primary mound, mound 9, Havana group, Havana, Ill. Submitted by Thorne Deuell, Ill. State Museum.	2336 ± 250
72	Tayinat, Syria. Wood from the floor of a central room (I-J-1st) in a large Hilani "palace" of the "Syro-Hittite" period in the city of Tayinat. Known age 2625 ± 50 Yrs. according to R. J. Braidwood. Submitted by the Oriental Institute, Univ. of Chicago.	2696 ± 270 2648 ± 270 2239 ± 270 Av. 2531 ± 150
159	Sequoia. Wood from the heart of the giant redwood known as the "Centennial Stump" felled in 1947 with 2905 rings between the innermost (and 2802 rings between the outermost) portion of the sample and the outside of the tree. Therefore known mean age was 2928 ± 51 Yrs. Submitted by E. Schulman, Laboratory for Tree-Ring Research, Univ. of Arizona.	3045 ± 210 2817 ± 240 2404 ± 210 Av. 2710 ± 130
364	Dolton, Ill. Wood from lacustrine beach, possible Lake Chicago (Tolleston or Algonquin Level.) Log found at base of lake sand overlying till in clay pit at Dolton, Ill. Submitted by H. Bretz, Univ. of Chicago.	3469 ± 230
81	Sesostris, Egypt. Funerary ship from tomb of Sesostris III Known age 3750 Yrs. according to John Wilson. Submitted by Col. C. C. Gregg, Chicago Natural History Museum	3845 ± 400 3407 ± 500 3642 ± 310 Av. 3621 ± 180
1	Zoser, Egypt. Acacia wood beam from tomb of Zoser at Sakkara. Known age 4650 ± 75 Yrs. according to John Wilson. Submitted by Ambrose Lansing, Metropolitan Museum.	3699 ± 770 4234 ± 600 3991 ± 500 Av. 3979 ± 350
12	Sneferu, Egypt. Cypress beam from tomb of Sneferu at Meydum. Known age 4575 ± 75 Yrs. according to John Wilson. Submitted by Forelich Rainey, Univ. Museum, Univ. of Penn.	4721 ± 500 4186 ± 500 5548 ± 500 4817 ± 240 Av. 4802 ± 210
267	Hemake, Egypt. Slab of wood from roof beam of tomb of Vizier Nemaka, contemporaneous with King Udimu, 1st Dynasty, at Sakkara, Egypt. Accepted age 4700 to 5100 Yrs. according to Braidwood. Submitted by W. B. Emery, c/c British Embassy, Cairo.	4803 ± 260 4961 ± 240 Av. 4883 ± 200

164 Bat Cave, New Mexico. Corncobs and wood fragments from the debris in Bat Cave, New Mex. The depth below the top correlates with the development of corn from a primitive form at the lowest layer or 6 ft. to essentially modern corn on top. Excavated by Herbert Dick in 1949 and 1950. Submitted by P. C. Mangelsdorf, Harvard Univ.:

Sample	*Layer (depth)*	*Ave. (years)* C_{14}
167; cobs	0 — 12"	1752 ± 250
567; charcoal	11" — 15"	1510 ± 200
173; wood	1' — 2'	1907 ± 250
172; wood	2' — 3'	2239 ± 250
569; charcoal	2' — 3'	2816 ± 200
164-171; corn and wood	3' — 4'	2249 ± 250
570; charcoal	3' — 4'	2048 ± 170
170; wood	4' — 5'	2862 ± 250
573; charcoal	5' — 5' 6"	5931 ± 310

419	Lake Butte, Wis. Glacial wood (cf. Bulletin of the Geological Society of America, Vol. 54, P. 136, 1943) found between Appleton and Menasha, Wis., on the eastern shore of Little Lake Butte des Morts. Log protruded from a sloping bank of varved clay, perhaps reworked but older than the surface till of Valder's Drift; appears flattened by pressure. Collected and submitted by F. T. Thwaites, Univ. of Wis.	5938 ± 300 6864 ± 300 Av. 6401 ± 230
432	Danish Boreal. Pine cones from Denmark (Seeland, Aamosen; Ogaarde-K, PO 1949). They are from pollen zone V, thought to be 8500 Yrs. old. Submitted by J. Troels-Smith, National Museum, Copenhagen.	7583 ± 380
433	Danish Boreal. Hazel nuts from Denmark (Seeland, Aamosen; Kildegaard-K, Ul.O, house 1). The nuts are from one single summer dwelling, belonging to the late boreal, pollen zone VI. Thought to be about 8000 years old. Submitted by J. Troels-Smith, National Museum, Copenhagen.	9935 ± 440 9927 ± 840 Av. 9929 ± 350

308 Two Creeks, Wis. Wood and peat samples from Two Creeks Forest bed, Manitowoc, Wis. Forest bed underlies the Valder's Drift (Thwaites). Apparently the spruce forest was submerged pushed over, and buried under glacial drift by the last advancing ice sheet in this region. Thought to be Mankato in age.

Sample	*Collector*	*Age (years)* C_{14}
308; sprucewood	L. R. Wilson, Univ. of Mass.	10877 ± 740
365; tree root	J. H. Bretz, Univ. of Chicago	11437 ± 770
366; peat in which root (365) was rooted	J. H. Bretz, Univ. of Chicago	11097 ± 600
536; sprucewood	J. H. Bretz and L. Horberg, Univ. of Chicago. Collected in 1950, several years later than 308, 365, and 366	12168 ± 1500
537; peat	Same as 536	11442 ± 640
	Average of five samples	11442 ± 350

STANLEY E. HEGGLAND, JR.,
in *Esconi News*, Feb., 1952

Grieger's, 1633 East Walnut Street, Pasadena 4, Calif., announce an 11-page Mineral Catalog largely intended to aid the beginner in starting a not-too-expensive collection. Most of the specimens advertised run about 25c apiece and it appears that this is an incentive to create interest among the younger students. Such a plan is in accord with the aims of this magazine. We wish them well in this venture.

* * *

Mr. J. S. Franks, well known in Chicagoland's amateur photography circles, lives at 2303 S. 60th Ct., Cicero 50, Ill.

Hunting for Petrified Wood in Colorado County, Texas

by Cash C. Hale

Keystone Exploration Company, Box 126, Fairbanks, Texas

Here it is Saturday morning and there are so many things which I have planned to do, but have never found the time in which to do them. I am wondering about where to start in when a subtle idea strikes me.

"I believe that I will go over to Schulenberg, Texas and hunt for some petrified wood, Retta." I tell my wife.

"I would like to go with you, but Tony is too small to take out."

"I know. I'll stop by George Fegan's place and see if he will go with me. I'm almost sure that he will go."

I grabbed "Gem Hunter's Guide" and drove the five mile distance to where George lives. He was still in bed, enjoying the most obvious of all luxuries which bachelors enjoy—i.e. sleeping late.

"George, would you care to go with me to Schulenberg and *prospect* for some petrified wood?" I asked him before he was fully awake.

"How do you know that there is any petrified wood there?" He countered doubtfully.

"It says so in Mr. MacFall's book 'Gem Hunter's Guide.' "

"I had better not go today. I need to catch up on the physics course which I am taking by correspondence."

"Well. I thought I would drop by and ask anyway. I surmised that you were lonesome since your room mate, Gene Foshee, moved out and went to a crew in California. I'll drop you off at Mrs. Rohrers for breakfast if you want, since it would save you a mile of walking and it is not out of the way for me."

"Um-m-m. Wait until I jump into my clothes."

I had already formed misgivings about my decision, but just as I pulled in at Mrs. Rohrer's George slid out and surprised me with:

"Wait until I grab a bite, and I will go with you!"

"All right! That's a deal!"

I turned off the switch and sat in the car studying my "Official Texas Road Map" while George was eating breakfast. I would have to go about a mile west of Fairbanks, Texas on U. S. 290, turn left three miles on the Britmore Road to U. S. 90, turn right, and stay on U. S. 90 all the way. Almost before I realized it, George had finished breakfast and came out ready and "raring" to go.

We drove along in my '38 Ford coupe and commented on the weather looking foggy, the trees greening out, Johnson grass being over ankle high, the many cattle ranches along the way, and the fact that bluebonnets, the state flower of Texas, were in bloom. We crossed the Brazos River, noting the wide flood plain, and the San Bernard River while George kept watch in the meantime for outcrops of rocks.

He remarked, "I would like to find some good fossils in limestone. I have always wanted a good fossil collection."

"I will help find some good fossils for you. We will stop at some likely looking outcrops. I've seen some that would make your mouth water, but of course you realize that most of the nourishment has been leached out of them!"

George picked up "Gem Hunter's Guide" and read out of it while I was driving along, glancing occasionally at the sides of the road.

"Where did you get this book?"

"I ordered it from the Science and Mechanics Publishing Company."

"How much did it cost?"

"I think that it was about three dollars."

"I had better get one. It has information I have never seen nor heard of before. I like it and believe that it is well worth the price."

"I do too. I don't take a trip without it now."

I glanced out at the road cuts along the sides of the highway after we had passed a roadside park. The landscape had begun to emerge from flatland into rolling hills. I noticed that the tops of the hills where highway cuts were made showed white gravel outcrops.

"We will stop just beyond the crest of this hill. I want to see what kind of gravel outcrop I have been watching."

"Say! That looks interesting, doesn't it?"

"Yes, and we will find out what kind of minerals those gravels are composed of anyway."

"Who said a couple of oil geologists couldn't turn gem hunters?"

"Not I. I flunked petroleum geology in college!"

I stopped at the side of the highway where we got out and started looking. The largest gravels were about two inches in diameter. We found some rounded fragments of jasperized, agatized, and opalized wood, crystalline quartz, flint, chert, two lower valves of a probable Cretaceous oyster, and a chert gravel containing some ostensible Pennsylvanian crinoid sections.

We later crossed the Colorado River of Texas, passing through Columbus, continuing westward about ten miles. We stopped at a deposit of coarse, whitish gravels ranging upward to cobblesized. We jumped out and the hunt started with enthusiasm. George drew blood first. He found a nice-sized fragment of beautiful jasperized wood weighing about a pound. The weather had precipitated to a sprinkle about that time, so all of the rocks were wet, but it didn't rain hard enough to drive us back to the car. We began to pick up flint, chert, chalcedony, jasper agate, sardonyx, quartzite, petrified wood, and jaspillite. We gathered ten pounds of mineral specimens in about ten minutes, but spent an hour reworking the area.

The gravels occur in what appears to be an ancient river bed on the hill top. I couldn't decide upon the age of the deposit, but some of the gravels had traces of a conglomerate with ferruginous cement which commonly occurs in the lower Cretaceous adhering on them. We also found an agatized *Favosites* (honeycomb) Coral which was probably a Pennsylvanian limestone, and another jasper gravel with an imprint of the brachiopod, *Dictyoclostus americanus*, which dates Permo-Pennsylvanian in age. The gravel in that particular deposit had to come from two different origins: one; an original cherty limestone which has since become silicified, and two; the shale which silicified millions of tons of wood sometime during the Mesozoic era, dated by the wood, which showed annular rings. The gravels were sorted by size, transported, mixed and cemented by ferruginous material into a conglomerate, eroded out, retransported, and deposited at the present location. The most striking face is the remarkable similarity to the gravel of south-eastern Oklahoma, indicating that the primary deposit was split somewhere by an uplift during post-Cretaceous time.

Those rounded gravels are of economic importance as a source of gravel and ballast for construction, road paving, and fill. The modern counterpart in the bed of the Colorado River is called "torpedo sand."

We stopped in Weimar, Texas, and ate a good southern-fried chicken dinner. We noticed that the land in that area was black, indicating a limestone origin. We drove northeast of Weimar about five miles until the pavement ended in a gravel road hoping to find some fossils. We ended up in sandy country losing any trace of limestone. We gave up looking for fossils, and began to examine the road gravel. It was identical with the deposit which we had left east of Weimar, so we didn't bother with picking up too many samples from the county road. I will say that the state of Texas is extravagant, for they pave their roads with petrified wood.

We started home without having arrived in Schulenberg. We drove to within seven miles of Schulenberg, without getting out of Colorado County, Texas. The most exciting event on the way home was when I got careless and let one of my wheels drop off the pavement, jolting George out of an incipient nap, and nearly throwing me into a skid. We stopped at Francis' Cafe in

Fairbanks, Texas, and drank a cup of coffee. I mentioned division of the specimens, but George wouldn't hear of it. He said for me to be sure and send Mr. MacFall some good samples. I assured him that I would. I felt like a heel, asking him to go along, and he not taking any specimens.

I realized later why he had refused, especially after I had washed and cleaned a bushel of specimens. "For every silver lining—a cloud!" I say.

AN ARCHAEOLOGY INTEREST GROUP IN ESCONI

by DAVID J. WENNER, JR.

This paper describes a newly formed archaeology interest group in Esconi, the type of organization it hopes to develop, the aims and purposes of the group and something of the present and future activities.

The most common type of amateur archaeological organization has been almost solely concerned with collecting as an end in itself. The organizations or members within the group received recognition for the number or quality of artifacts in their collection. Such collections are often extensive and comprise a wide range of artifacts and many really beautiful individual pieces —truly "a thing of beauty and a joy forever." The largest and finest collections, representing years of work, however, are often practically useless for interpretation of the prehistory of a region because the collector did not have the opportunity to learn modern archaeological methods or did not choose to apply them.

A less common type of archaeological organization has developed within the past few years. These societies work in close cooperation with individuals or institutions engaged in scientific archaeological research with the result that both groups are benefited. These contacts have changed methods of collecting as well as given the collecting of prehistoric artifacts a new meaning. Outstanding examples of the above type of organization are the Missouri Archaeology Society, organizations cooperating with the Upper Ohio Valley Archaeology Survey of the Carnegie Museum of Pittsburgh, and the amateur groups aiding the River Basin Surveys of the Smithsonian Institution.

During the Winter of 1951-52 an archaeology interest group was formed in The Earth Science Club of Northern Illinois. This group is composed of people who, through reading, traveling, visiting museums, or personally collecting prehistoric artifacts, have become interested in the field of archaeology. The plans and actions of this group to date have shown that an organization of the new type is developing. Its aims and purposes have never been officially put into writing, but from the discussions at the various meetings the following can probably be said. The group is interested in learning of the scope, concepts and methods of archaeology and its related fields, in learning about the prehistoric cultures of the Illinois areas and related areas, and in cooperating with institutions engaged in archaeological research. Perhaps the most important aim of the ESCONI group will be to contribute to building up a systematic and scientific collection of usable information that will aid in learning more about the prehistory of the little known Northern Illinois area. Its members will not advocate the commercialization of artifacts and "pot hunting" since these practices are not in the best interests of scientific inquiry.

The past winter has been spent in talks and discussions of a general and introductory nature. The amount and types of archaeological research in Illinois and particularly northern Illinois has been discussed along with a description of some of the better known prehistoric cultures of the area. The University of Chicago has done some work in the Chicago region resulting in some short published reports, but as a whole the area has not been systematically surveyed nor reported upon.

The current project and one that will continue for some time is to plan and conduct an extensive archaeological survey of the Chicago region. The first season is expected to be one of learning survey methods. A card index is being set up on known and reported sites, collections and collectors in the area. Collections useful to the survey will be photographed and described if permission is granted. Sites located in the area will be assigned numbers, plotted on maps and a site report will be filled out on each. The site reports will be sent to the Illinois State Museum and copies kept for the ESCONI group. Artifacts found will be described and kept separated according to sites. One result of the survey will be a clearer picture of the cultural complexes in the area and a better idea of their distribution. At the end of each season it is hoped that a progress report can be written. The survey will be entirely a surface survey since the group has neither the "know how" of excavation nor the inclination to destroy useful scientific data through ignorance.

FINDING NEW RECIPES FOR ROCKS

by MRS. MARIAN WILLEMS

So reads the title line of an article in the current issue of the University of Chicago Magazine. Then, because it came within the range of my eye, I read the closing paragraph. Dr. Laves recounts a story, from his days at Gottingen University, of a professor there who made the wearing of evening clothes compulsory in his chemistry lab; his intent was to teach the meticulous care with which lab work should be done. "It was a good lesson," says Laves. "Here we don't wear evening clothes, but we are very careful."

In between these frivolous sounding lines lies the weighty matter of the article.

Chemistry had its origins in mineralogy long before it branched out into the study of more transitory substances and now geology is moving more and more toward geo-chemistry. In a manner of speaking, this completes the circle. The confines of the laboratory with its ever increasing apparatus takes the place of the geologists' old lure, the field trips to canyons and caverns.

Completely new synthetic mineral compounds are coming into existence in the geology laboratories of the University, which in time may reveal little understood phases of the earth's beginnings. Even now they have added to the knowledge of old line natural rocks. Working in the Rosenwald laboratories, Fritz Laves, Associate Professor of Crystal Chemistry, and Julian Goldsmith, Research Associate in Geochemistry have achieved the synthesis of nine new "minerals" in their attempts to answer puzzling questions about the structure of the feldspars which are alumina-silicates with sodium, calcium or potassium added.

The feldspar, as you know, is about the most common constituent of the rocks which make up the known and explored part of the earth's bulk, an epidermis, as it were, only ten miles thick. It occurs as granite when combined with quartz and a few other minerals; as a principle component in basalt, and of all the other igneous rocks. (*Continued on page* 32)

EARTH SCIENCE QUIZ NO. 2

Test Your Knowledge! How much do you know? How many of the following terms can you define? They are arranged in three groups with progressive difficulty. Group 1, things everybody should know; group 2, things good "rock-hounds" should know; group 3, things which experts might be expected to know. Try your luck. To score—add up total points as indicated by the group number and rate as follows: 1-6 poor; 6-13 good; 14-20 excellent; 21 perfect.

a.—(1) fool's gold	e.—(1) silica	i.—(2) humus
b.—(1) brimstone	f.—(1) marl	j.—(3) refractivity
c.—(1) amorphous	g.—(2) bort	k.—(3) horn silver
d.—(1) oxide	h.—(2) conchoidal	l.—(3) gossan minerals

(for answers, see page 46)

The problems offering themselves in the feldspars had to do (1) with the question of where certain of their atoms were arranged in specific ordered patterns within the crystals, or whether they were distributed at random, and (2) the attendant question of whether the atom arrangement is affected by heat and to what extent. IF THESE PROBLEMS WERE ANSWERED, THEY COULD INDICATE HOW HOT THE ROCKS WERE WHEN THEY WERE ORIGINALLY FORMED. Determining this order-disorder relationship by the usual methods of studying X-ray diffraction pictures was impossible, because two of the elements, characteristics of these feldspars—silicon and aluminum—are sufficiently alike, crystalographically speaking, to cause reflection patterns that are indistinguishable. Dr. Goldsmith, therefore, set about to substitute for aluminum an element of noticeably higher atomic number (the number governs the diffraction intensity) but of about the same size and charge, the element *gallium*. For silicon, he found that he could use *germanium*. Working with these atoms he found that by substituting them one at a time, and then together, he could form three new types of each of the soda, calcium and potash feldspar. THESE HAD NEVER OCCURRED IN NATURE. In the lab one of them — calcium-based anorthite — already has given promise of showing that there IS an orderly pattern of the silicon and aluminum atoms, and also to indicate the likelihood that the component which exhibits disorderly conduct when the heat is on is the calcium. Also, in anorthite, the silicon-germanium pattern (or the gallium-germanium pattern or the intergrades) stays put through the whole temperature range from 1100°C. to the melting point, 1550°C., while the parts of the X-ray picture made by the calcium grow progressively fuzzier.

The work of the lab group has been financed in part by the Office of Naval Research. Good progress already has been achieved in the feldspar work, and the research team expects soon to broaden the area of inquiry. One of the next items on the investigative agenda is a combined thermal-X-ray study of "zoned" crystals of the plagioclase" feldspars. Enough work has been done on that problem that Dr. Goldsmith feels some of the results attained bear directly on the question of the state of the earth's rocks when the earth was first formed.

And so instead of pickaxes, considerable numbers of contemporary geologists are working with thermocouples and precision cameras.

—*M.G.A. Bulletin*

INTEREST ITEMS

Erratum: Page 15 of the July issue of the Digest, "Chubb Crater—Toronto, Ontario" should have been "Chubb Crater — Ungava, Quebec." Dr. Meen is Director of the Royal Museum of Geology and Mineralogy, which is at Toronto, Ontario. We regret the blunder —and it was such a good article, too.—Ed.

* * *

For his article called "Two Localities of Alpine County, California," Merritt Herring has won the first prize of a $25 Savings Bond in the latest essay contest sponsored by the American Federation of Mineralogical Societies.

The winner, who was a student in El Cerrito High School at the time of his entry into the contest, now lives in Berkeley. He has been interested in the earth sciences since the age of seven. His article reveals an unusual spirit of observation and exploration, and is illustrated with his own photographs.

The contest, which was arranged by Richard M. Pearl of Colorado Springs, had entries from all parts of the country. The judges were Frank L. Fleener of Joliet, Illinois, Olivia McHugh of Salt Lake City, Utah, and Robert Deidrick of Oakland, California. Acceptance of the winning essay was made by the delegates to the Canon City convention of the Federation during the last week in June.

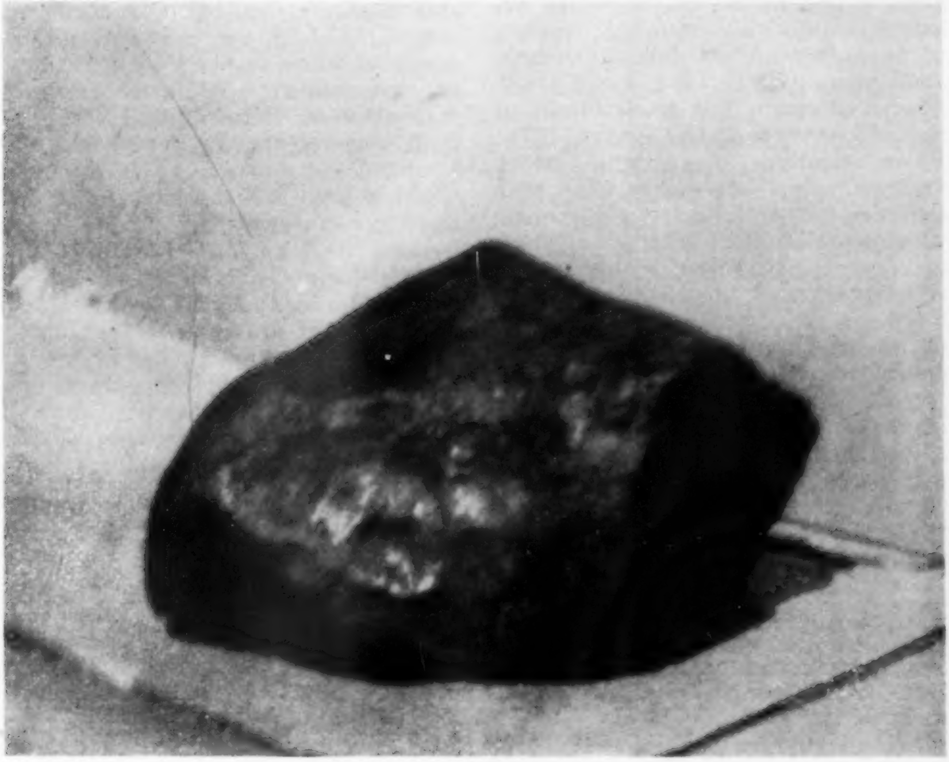
The Haven Chondrite

by Russell A. Morley, 399 N. 18th St., Salem, Oregon

ABSTRACT

The Haven, Reno County, Kansas, aerolite (ECN=+0977,379; cl.=veined crystalline chondrite, Cka) was discovered by Mr. George Westfall, in September 1950, *while he was engaged in drilling wheat on his farm. The meteorite is the first to be recovered in Reno County, or for that matter, in the entire Arkansas Valley. The aerolite has a total weight of* 2948.4 *grams and a specific gravity of* 3.523 *at* 19.5°C. *Nearly the entire specimen is covered with a fusion crust. The main mass of the meteorite is preserved in the H. O. Stockwell collection.*

The Haven aerolite was discovered by Mr. George Westfall, in September 1950, while he was engaged in drilling wheat on his farm, which is located north-east of the town of Haven, Reno County, Kansas. The strange rock was first noticed by Mr. Westfall several years previous to his discovery, but at that time he did not bother to climb down from his tractor for a closer examination. During the intervening years Mr. Westfall made numerous trips to Hutchinson, where he was a customer of the Hilton Electric Company, Mr. H. O. Stockwell's place of business. While on one of these visits Mr. Westfall noted that several specimens in the fine collection of meteorites, which Mr. Stockwell has on display for his customers, were in many respects similar to the odd-looking rock in his wheat field. The next time he encountered the rock he stopped his



The Haven Chondrite—1/2 size.

tractor and got down for a closer inspection. The rock so much resembled some of the stony meteorites which he had seen in the display that he picked it up and took it home, where it was later purchased by Mr. Stockwell, who recognized it as an entirely new meteoric find. The meteorite was later cut by Mr. Stockwell, and several of the slices were removed and forwarded to me for further study.

The exact location of the Haven chondrite is 4 miles north and 2 miles east of the town of Haven, Reno County, Kansas, in the Cheney quadrangle, on the George Westfall farm which is located in the S. ½ of the N.W. ¼ of Sec. 15, T 24, R 4 W. The Longitude of the place of find is approximately W. 97° 45′ 21″ and the latitude is N. 37° 57′ 51″. This location has an equatorial coördinate number (ECN) of +0977,379.

The Haven is the first meteorite to be recovered in Reno County, Kansas, and for that matter in the entire Arkansas Valley. The overall dimensions of the mass are as follows: length, 186.5 mm.; width, 128.6 mm.; thickness, 88.9 mm. The total weight of the specimen is 2948.4 grams. The Haven aerolite is covered with a heavy dark brown primary fusion crust with the exception of the base and one end which show signs of fracturing. There is a secondary fusion crust on the thinner edges of the resulting irregular surfaces. The remaining portion of the fractures is unfused and of a yellowish color. The entire specimen is covered with a number of pit-like depressions some of which are as great as 6 mm. in diameter. There are 5 or 6 hair line cracks which appear on the surface. The heavily fused side with 10 distinct pits is well shown in the photograph (Fig. 1). Several slices of the meteorite which were polished and stored for sometime in a box developed a considerable deposit of molysite ($FeCl_3$) and limonite ($Fe_2O_3H_2O$) which was derived from the alteration of the unstable lawrencite ($FeCl_2$).

The following data was derived from a study of a 24.3 gram polished slice which measured 52.2 mm. X 39.1 mm. X 4.5 mm. in greatest dimension. The Haven meteorite belongs to the class of veined crystalline chondrites (Cka); however I observed that on several of the slices studied, little or no veining occurred except near the outer periphery of the specimen where for the most part the veins run parallel with the outside surfaces. Nickel-iron is fairly abundant and evenly disseminated throughout the firm crystalline mass. The meteorite has many small fractures, few of which connect with the outside surface. The specific gravity of the Haven chondrite is 3.523, at 19.5°C. as determined with a precision Jolly balance. The main mass of the Haven meteorite is preserved in the H. O. Stockwell collection.

* * *

NOTICE OF SPECIAL INTEREST

We have received a memorandum from the Conference Board of Associated Research Councils, Committee on International Exchange of Persons requesting "announcement for the 1953-54 competition for Fulbright awards for university lecturing and post-doctoral level research in *Europe and the Near East*. Included in this competition are awards for Austria, Belgium and Luxembourg, Denmark, Egypt, France, Greece, Iraq, Italy, Netherlands, Norway, Turkey The United Kingdom and Colonial Dependencies. Also included are awards for Japan, Pakistan, and the Union of South Africa. A Fulbright Agreement has recently been signed with the Union of South Africa and a very small program will be initiated for 1953-54.

The Committee is preparing a detailed program booklet concerning the awards referred to in this announcement. The booklets are expected to be available early in July. The closing date for making application is October 15, 1952. Requests for information should be sent to Francis A. Young, Exec. Sec., 2101 Constitution Ave. N.W., Washington 25, D.C.

* * *

The Asteriated Gems—

by W. B. S. Thomas, Lyons, N. J.

Beauty, one of the attributes of a gem, is born of light. The emerald is grass green, the ruby pigeon blood red, only because each absorbs all except one color from the spectrum of white light, and that rare color makes it valuable. Similarly, a comparatively small number of gems owe their beauty primarily to the peculiar tricks they play with light. These are the chatoyant, the asteriated, the iridescent and the opalescent gems—exotic orchids of the mineral world.

Chatoyant is a picture word that refers to the shimmering streak of light reflected from the contracted pupil of a cat's eye. Literally, it means like a cat's eye. Chatoyant stones have a wavy, silky sheen, usually concentrated into a line on the top of the cabochon cut gem, and caused by reflection from tiny parallel fibers. The streak or line crosses the direction in which the fibers run, and the finer they are and the more symmetrically they are arranged, the sharper and more brilliant will be the streak.

There is nothing mysterious about chatoyancy. Examples of it occur in everyday life. Sun or moon light falling on still water makes an elliptical spot of reflected brilliance. If a breeze causes ripples in the water parallel to the horizon, the spot of light will become a streak crossing the ripples and pointing to the horizon. Romantic couples who have looked on such a reflection call it a moonpath.

As the observer walks along the bank, the streak of light will follow him, just as in a piece of tiger's-eye the chatoyancy will be evident all the time as the stone is rotated on its long axis.

Chatoyancy then is internal reflection seen in a single plane, the ripples or fibers scattering the light along a plane between the water or the stone and the eye, and at a right angle to the water ripples or the fibers.

A simple experiment will show that asterism, the phenomenon which is perhaps best known in the star sapphire and ruby, is the same nature. Sit in your car in the dark facing a bright street lamp some distance away. Run a finger alongside your nose or thru your hair to make it oily. Then between your eye and the lamp make an oily smear or streak on the windshield. The tiny parallel streaks or ripples of oil will cause the lamp to appear as a horizontal streak of light. This is chatoyancy.

Now make two more gentle smears like an X—one a diagonal down from left to right and the other down from right to left, crossing the first streak. The lamp, viewed where the three streaks meet, will appear as six narrow bands of light radiating from a center like the conventional representation of a six rayed star. This is asterism. The star is made up of three planes of chatoyancy which intersect and are at right angles to the directions of the streaks. This is the pattern seen in the star sapphire and ruby.

Another pattern as asterism—a four rayed star such as occurs in the star garnet — can be made by two such smears intersecting at right angles. Or such a four-rayed star can be seen by looking at night at a distant light through the meshes of a screen door.

Any translucent mineral that is composed of or includes parallel fibers, tubes or strings of particles will, when properly cut into a shallow cabochon, be chatoyant. The most precious and beautiful of these gems is chrysoberyl cat's-eye, found in Ceylon, the Ural mountains and Brazil. Usually it is a clouded honey yellow or a vaseline green, with a vivid streak of white, the "eye," shimmering on top of the stone. The most prized stones are a luscious, almost transparent yellow with a single and sharply defined streak. The chatoyancy is attributed to the presence of thousands of tiny, hollow tubes in parallel arrangement. Several other minerals are also chatoyant, among them beryl, corundum, silicified crocidolite, hematite, the pyroxenes hypersthene, enstatite and bronzite, quartz, scapolite, satin spar, spodumene and tourmaline.

Light green common beryl, such as is found in New Hampshire and North Carolina, is the variety that is most commonly chatoyant, but some of aquamarine color and nearly transparent shares this quality. Translucent corundum, when cut parallel to the principal axis of the crystal, will often show the same effect.

Tiger's-eye from Africa is a form of asbestos, crocidolite, in which the fibers of that mineral have been replaced by quartz, which has retained the fibrous structure. As it occurs in veins with iron minerals, most of it is colored yellow by limonite or red with hematite, but some keeps the blue color of the original crocidolite. The blue variety is often called hawk's-eye. Tiger's-eye displays elaborate chatoyant bandings which can be manipulated by the cutter into single band, bull's-eye, and cameo effects. Once quite costly, it became cheap when the extensive deposits at Griqueland West were found.

The German cutters used to produce a great many quartz cat's-eye cabochons which were quite chatoyant but an undistinguished greenish gray in hue. A silicified hematite that is strikingly like red and yellow tiger's-eye is found in the Minnesota iron mines and in glacial drift south of them. The material, known locally as binghamite, presumably is formed by silicious replacement of finely crystalized needles of hematite.

Chatoyant scapolite of gem quality is a rarity. The best, a delicate rose pink, comes from Burma or Ceylon. The Bolton, Mass., scapolite, however, is often chatoyant, although the effect is likely to be patchy, owing to the irregular arrangement of the fibers. Likewise, the Bancroft, Ont., scapolite altered to pink canthrinite, and yellow wernerite from the same locality, when cut into spheres give handsome cat's-eye effects.

Satin spar is the name given variously to fibrous calcite, aragonite or gypsum. Its attractiveness depends almost entirely on the silky sheen of its fibers, as its color is usually white and it is too soft for any use except for carvings. If the material were hard and less fragile, it would make an excellent gem because of its structure.

Lilac spodumene from the Strickland quarry at Portland, Conn., and from Lithia, Mass., is almost entirely unknown among gem cutters, but this opaque to translucent material, when in well preserved crystals, yields outstanding cat's-eyes. In a steep cabochon the edges of the stone are grey or lilac and translucent, while the chatoyant streak is white.

The tourmalines of Maine and California will occasionally include a chatoyant stone of the finest description. Such stones, indeed, more nearly approach the chrysoberyl cat's-eye in splendor and value than does any other type of gem. In a few instances a tourmaline cat's-eye will also display the watermelon—half pink and half red—idiosyncrasy of the mineral.

Best known among asteriated gems are star sapphire and ruby, but rose quartz, garnet, green, green zircon and aquamarine also have a place among the stars.

An outstanding star sapphire should be somewhere near the prized cornflower blue and also should display a well defined, six-rayed star centered on the apex of the steeply sloped cabochon. Unfortunately, the nearly transparent, well colored stones usually have weak stars; milky, pale stones far surpassing them in that respect.

Asterism is generally more marked in sapphire than in ruby, so much so that it is rare to find a ruby of good color that shows a distinct star. Most star rubies are pink and cloudy. In this respect the newly marketed synthetic star sapphires and rubies far surpass natural stones; for the synthetics have well defined stars and vivid color. They are too good to be true. Like other asteriated stones, star rubies and sapphires show off well under a single light source, such as a center light or the sun; indirect lighting or flourescent lamps give a poor account of their beauty.

Star quartz is light rose or milky in color and has a greasy luster. Spheres marked by well defined six rayed stars are often cut from it. These, when sawed into two hemispherical cabochons and backed with blue paint or foil or blue mirror glass, have a startling resemblance to star sapphires. Such quartz is found in Maine, California, Bedford, N. Y., North Carolina and Canada. Quartz spheres are somewhat anomalous in that they may show a four-rayed star from one angle, a six-rayed one from another, and twelve irregularly spaced rays when a second small distant light is used to illuminate one of the six rayed stars.

Star garnet, such as that from Idaho, can be oriented by cutting the 12-sided crystal into a sphere to find four raved stars. By sawing the sphere in half two cabochons—each with a star—are produced.

Asterism is attributed to reflection from fibers or fibrous inclusions, tiny hollow tubes or strings of colloidal particles symmetrically arranged or trapped in the gem crystal along lines of growth or of twinning, where layers or lamellae are formed on top of one another. These cross within the stone just as the streaks crossed on the windshield of a car mentioned in a previous illustration. In hexagonal crystals, such as those of quartz and corundum, these are inclined to one another in three directions at 60 degrees. In isometric crystals, such as garnet, they are inclined in two directions at 90 degrees.

The phenomenon is well exhibited in a piece of mica from Connecticut, which has as an inclusion a black spot the size of a dime. When this is held near the eye and a distant light is observed through it, a sharply marked six-rayed star breaks through the darkness. Under the microscope it becomes evident that the black spot is a mass of thousands of slits arranged in a series of isosceles triangles with their similar sides parallel. The effect is that of three sets of slits intersecting at 60 degrees.

Several other gems are cherished because of the related tricks they play with light. Moonstone, a white translucent feldspar, owes its matchless blue sheen or schiller to an oddity of structure. It is a mixture of orthoclase and albite feldspars arranged in thin layers which reflect back a shimmer of heavenly blue. The best effect comes from stones in which the layers are very thin. The pearl, incidentally, owes its precious orient to a similar arrangement of thin corrugated layers, like the leaves of a well formed cabbage, which turn white light into a soft blend of colors.

Labradorite, also a feldspar, is made up of layers as a result, it is assumed, of repeated twinning in the crystals. These platelike crystals refract and reflect light in glowing green, red and yellow flashes, although the body color of the mineral is a dull gray.

Opal, is now generally believed to be a kind of solid jelly of silica in which thin films varying in their refractivity formed as the jelly solidified. These films break up white light by interference, resulting in the play of color known as opal-escence. The same effect is seen in soap bubbles, ancient glass and a thin film of oil.

Thus, in various ways, light paints its beauty into some of the rarer inhabitants of the mineral kingdom. Such gems have a fascination all their own, which recognizes that each is in a sense a fortunate accident of crystallization, an exotic product of the vast forces of magmatic fires, of the timeless work of seeping waters and of the restless sea. Unlike most gems, these chatoyant and asteriated jewels are individuals, possessors of a personality whose attributes are mystery, beauty and curiosity. When their splendor is liberated by the art of the lapidary, they are indeed the orchids of the gem world.

* * *

Art was born when man first recognized color. I like to believe that it was the color of a beautiful rock.—W.

COAL—(from page 5)

beds and fresh-water forms in others. We also judge from the thickness of the coal accumulated from these swamps that the time interval must have been very great, perhaps millions of years.

Similar in some respects to these Pennsylvanian swamps, we find at the present time practically the same conditions existing in the great swampy areas of Southern Florida, and along the Atlantic coast, and in the Dismal Swamp region of Virginia, and in North Carolina. Also to be considered, are the various cypress swamps, and the multitude of peat bogs and marshes of the United States and Canada, that furnish further examples of the growth and accumulation of coal-making materials. In some of these swamps, where the surrounding land is low and permits of little or no inwash of sediments, or where the swamp itself is too large to permit the inwash, we find coal-forming vegetation accumulating, uncontaminated by sand or silt to any extent.

During the Pennsylvania Period the principal coal-forming plants were ferns, calamites, sigillarias, lepidodendrons, and conifers, but in all the subsequent coal beds these plants have been in the minority. We find that the plants contributing directly or indirectly to the formation of the later coal beds are many kinds of trees, ferns, grasses, mosses, etc. In most cases a number of plants contribute to the vegetable accumulation without any particular one predominating, and in other cases one certain plant or group of plants seems to be responsible for the accumulation. This is what we would expect from a study of present-day swamps and marshes, where we find certain plants living in geographically-controlled habitats. At the present time, in Europe, mosses (especially sphagnum) predominates in the peat-forming process. In America the bogs are largly being filled by aquatic plants as well as sphagnum. In Asia wild rice is the chief plant of the marshes and bogs. In South America the lush rain forests of the Amazon and Oronoco river basins are laying down deep deposits of tree trunks, mingled with all sorts of tropical plants in great heterogeneity and profusion. All these will make coal beds, if given the proper conditions and eons of time. *(To be continued)*

LAPIDARY SHOW—(from page 19)

After the show the winning exhibits were displayed at The Chicago Natural History Museum from June 2 through June 30, and were then exhibited at Marshall Field and Company, from July 7 through July 24. It was estimated that over 125,000 people viewed this outstanding exhibit during its six week showing.

INDIANA—(from page 21)

Along with the coral we found some "dog tooth" quartz crystals.

4. *OOLITE — CAVE ONYX*

Take Ind. Hwy. 37 northwest of the town of Orleans. About 1½ miles north of the town is the Radcliff-Barry quarry. In this quarry we found some beautiful pure-white öolite and some cave onyx, or banded calcite.

We saw some beautiful stalactites of the cave onyx high up in the wall, which had been exposed from a recent blasting. However, the rock was loose and we were cautioned not to attempt to climb the wall because of the danger involved. We did secure typical samples in short pieces, 4 to 6 inches long.

COLLECTING—(from page 22)

found on many of the larger fossils. There is a wide variety of these encrusting forms, bryozoans, sponge borings, corals, worm tubes, brachiopods, and even little edrioasteroids. Still higher and farther to the south lie immense thicknesses of the Upper Devonian shales. These are not as fossiliferous and are not as well known but they do contain fossils, especially of the fish and plants.

So, if you're a collector and you've never tried your luck in the Niagara Frontier, you still have a treat in store for you.

DEPARTMENT OF CLUB ACTIVITIES

Conducted by W. H. Allaway

Although this magazine officially represents the Mid-West, we would like to inform our readers of events that transpire elsewhere. We would, therefore, appreciate receiving data regarding these activities. Why not appoint someone in your club to send this information to me, W. H. Allaway, 4729 Prince Street, Downers Grove, Illinois?

— *MIDWEST* —

MINNESOTA MINERAL CLUB — Just ending a period of feverish activity during the big convention. These conventions keep the local groups hustling. Bill Bingham did a wonderful job as convention chairman. We are very interested in their write-up of Bob Lambrecht, 21307 Raymond Dr., Maple Heights, Ohio, in their "Rock Rustler's News," who came out of the service a double amputee. He has developed a special group of people in like condition and is specializing in making natural colored film slides of minerals. Take time out to drop him a line some time.

GEOLOGICAL SOCIETY OF MINNESOTA—Co-workers with the above club we wish to extend our congratulations to these two clubs for a wonderful convention. No one will ever know the hours of effort generously expended to make this convention a success. According to their bulletin, "The Minnesota Geologist," a series of lectures in geology is planned for the coming season. This is the type of activity that makes clubs successful. Lucky people to have such good lecturers in their midst. I heard them at the convention and know whereof I speak.

CHICAGO LAPIDARY CLUB — "The Template," Bulletin of this club, outlines the details of the very ambitious Second Annual Lapidary Show at Grand Crossing, May 17 and 18. A report on the show is given on page 19 of this issue. A great deal of originality was shown in the methods of display. Among the prize winners were Howard B. Menaer, Ken Russell, K. Tsuisaki, Henry Cox Jr., Louis Stalkus, Rose Sullivan and Helen Kennedy. Judges were Henry Essig, Robert Bower and Helen Rogers. Joe Arvey was chairman of the exhibit committee. The Lapidary Club is to be congratulated for such a big job so well done.

MARQUETTE GEOLOGISTS ASSOCIATION OF CHICAGO—We note that that "M. G. A." Bulletin has adopted the plan of recommending informative reading from the pages of various bulletins of other clubs, a plan that may well be followed by many other club bulletins. This bulletin is certainly full of interest for the amateur earth scientist.

EARTH SCIENCE CLUB OF NORTHERN ILLINOIS — In the "Earth Science News" bulletin for this club, one Bill Kelly breathes the spirit of high adventure and those of you who know him as I do will agree that he sees the geological features of this old globe with rose colored glasses instead of the usual dark variety. Every vacation is an event and he can be very demoralizing with his suggestions to tee off at a moment's notice for a rock pile he heard of somewhere. As usual things are cooking in this club. This year the club was asked to put on an Earth Science Exhibit for the Annual Fall Festival at the Downers Grove High School on August 31st. With J. E. Farr as chairman for the coming year this club will probably set an all time high for activity.

CENTRAL NEBRASKA ROCK & MINERAL SOCIETY — Members of this club held a special meeting at the home of their President C. H. Hide, in Hastings, Sunday July 20th, honoring Dr. Ben Hur Wilson, Historian of the Mid-West Federation and member of our staff. After a pot luck dinner served on the lawn, Dr. Wilson explained the work of the Federation and answered many questions regarding it.

This active organization is sponsoring an exhibit booth at the County Fair in August where lapidary work and minerals will be shown.

WISCONSIN GEOLOGICAL SOCIETY—The new officers of this busy club for the coming season will be: Oliver W. Lex, president; Edwin Pittelhow, vice president; Miss Ruth Nicoud, recording and corresponding secretary, and Joseph Wells treasurer. The Trilobite (official bulletin) staff will be Dr. H. W. Kuhmn, editor, and Doris E. Schomberg, assistant editor.

THE NEBRASKA GEM & MINERAL CLUB—B. F. Sylvester tells in the "*Popular Science Magazine*" for August, the story of Sharpe Osmundson and other "Rock Hounds" who are gradually converting their families to the fascinating hobby of collecting rocks and minerals. We are very glad to see the publicity that is being given these Earth Science subjects in our popular magazines and papers. This gives people who have an interest in this subject an opportunity to contact others who have similar interests.

TOPEKA GEOLOGY CLUB — We understand that a new club is in the making at Lawrence, Kansas and Dr. John M. Jewett of the State Geological Survey is one of the members. We will look forward to hearing more from them. In a letter from Olin R. Ives to Dr. Fleener we find that the Topeka Club has sent us a number of subscriptions. Many thanks and hope they enjoy this magazine as much as we do producing it.

THE COLORADO MINERAL SOCIETY—These people have been as busy as bees preparing for the June convention and judging by the array of talent that will be on hand, this should be an outstanding convention. Looks like all present officers headed up by James F. Hurlburt as president will be reelected for the coming year.

OKLAHOMA MINERAL & GEM SOCIETY—In their June meeting this club heard Dr. D. S. Harris discuss and watched him demonstrate the "Lost Wax" process of casting. Your writer tried it several times and not only lost the wax but the silver too. Their "Sooner Rockologist Bulletin" is very interesting and following in the wake of their last bulletin we find them concentrating on topaz.

"Though lacking the fire a diamond has,
Rare beauty is found in precious Topaz."

They also have I. Q. tests and believe it or not—an occasional quip.

CHICAGO ROCKS & MINERALS SOCIETY—New officers were elected at the June meeting, Claude Towne, President, and Lester DeMuth, Vice President. Morilla and Roger Wilson will furnish their program for September 13.

— SOUTHEAST —

THE GEORGIA MINERAL SOCIETY—Somehow we were lucky enough to find a copy of this society's "News Letter" among our Bulletins for review. Lucky people, they have a good cartoonist in their midst and freely mix facts and fun. They have had recent lectures on "Old Alabama Roads" by Dr. John H. Goff and the "Relationship of Physical Properties of Minerals" by Prof. H. E. Cofer, and field trips for Rutile, Lazulite, Kyanite and Prophyllite. "Unequal distribution of minerals I calls it!" We could use some of these in the Mid-west. Hope we hear from these people again.

— NORTHWEST —

OREGON AGATE AND MINERAL SOCIETY OF PORTLAND, OREGON —In their bulletin "Oregon Rock-hound" we find these people engaged in their 2nd annual Rock Show lasting three days with Melvin L. Kathan as General chairman. Over four thousand people visited their last show and that is really something. The theme for their Rock Show seems to run as follows.

To have a thing is nothing, if you've
not the chance to show it,
And to know a thing's nothing
unless others know you know it.
—Lord Nancy

Many thanks for the nice letter written to us by your editor, Mr. Cain.

NORTHWEST FEDERATION OF MINERALOGICAL SOCIETIES — Looking into the heart of the great northwest through the medium of the Northwest Newsletter, official publication of the above federation, we find that this great federation has 64 clubs and is headed up by Earl M. Van De Venter as President. Their convention was held at Caldwell, Idaho, Aug. 23 24 and 25. With the area so loaded with minerals and places of interest it is a wonder that every one in the northwest isn't a rock collector.

NOTE: Please send your bulletins in so we can publicize your activities.

DIAMOND IN THE ROUGH

A diamond in the rough
Is a diamond sure enough
For before it ever sparkles
It has the diamond stuff.

Of course someone must find it,
Or it never would be found.
And then someone must grind it,
Or it never would be ground.

But when it's found and when it's
ground,
And when it's burnished bright
That diamond's everlasting—
Just sending out its light.

Oh, Leader of ESCONI
Don't say "I've done enough,"
The newest in your club may be,
A diamond in the rough.

Cullen K. Paddick (Age 14)

from ESCONI NEWS for June

BOOK REVIEWS

OUT OF THE SKY, AN INTRODUCTION TO METEORITICS, by H. H. Nininger. Denver: University of Denver Press, 336 pp., biblio., $5.

The observation, recognition and discovery of meteorites are one field of earth science where the professional must depend on the help of informed laymen, because only a few of the millions of meteors that enter the earth's atmosphere every day survive to strike the ground. Their discovery, therefore, rests on chance and on the sharp eyes of the person fortunate to be near the scene of the fall.

Dr. Nininger, widely known to earth science enthusiasts because of his years of service to meteoritics as director of the American Meteorite museum near the great meteorite crater in Arizona, has written this book as a textbook and as a general introduction to the subject for interested amateurs.

He describes the major falls, characteristics of meteors and of meteorites, both stony and iron; methods of tracking the falls; theories of the origin and formation of meteorites and of tektites. The book is superbly illustrated and well manufactured.

DANA'S MANUAL OF MINERALOGY, 16th edition, revised by Cornelius S. Burlbut, Jr. New York: John Wiley & Sons, 530 pp. $6.

Dana's Manual is certainlv the most useful single book for the collector who is beyond the neophyte stage, and its latest revision, contains new material of value to the student and collector.

The sixteenth edition is 50 pages longer than the preceding one and differs from it principally in the addition of a preliminary chapter on the history of mineralogy, the nature of minerals and practical applications of the science, and in a new section on crystal chemistry which embodies new concepts of crystal structure which are fundamental to an understanding of minerals.

Figures on the economics of mineral production have been brought up to date, several new figures and photo-

(Continued on page 44)

graphic plates have been added, and the impact of nuclear chemistry is evident in the treatment of such a mineral as uraninite. Some revisions of crystal classes have also been made, which are of value to the advanced student, and the typography of the book has been modernized.

Valuable features, such as the excellent and non-technical discussions of crystals, of physical, chemical and descriptive mineralogy, of the occurrence of minerals and of their industrial uses, and the determinative tables and indexes, are retained and brought into harmony with modernized nomenclature.

INTRODUCTION TO GEOPHYSICAL PROSPECTING, by Milton B. Dobrin. New York: McGraw-Hill Book Co., 435 pp. $7.

Much present day exploration for oil and, to a lesser extent, for ore minerals, is based upon geophysical methods, which includes methods of measuring the nature, extent and dip of rock strata buried deep beneath the ground by means of gravitational, magnetic, seismic, electrical and radioactive vari ations detected with delicate instruments. Many of the results are only suggestive, but they are among the best available for finding geological structures worth exploring further for oil and minerals.

The author, who is senior research technologist, field research laboratories, Magnolia Petroleum company, describes all modern methods, including many no longer used, in some detail, illustrating his discussion with sketches, photographs, equations and other necessary material. Although none of the book is highly technical, it is by no means elementary and is intended for senior and graduate students in geology and for professional geophysicists and executives called upon to pass on the results of geophysical surveys.

PRINCIPLES OF GEOCHEMISTRY, by Brian Mason. New York: John Wiley & Sons, 276 pp., $5.

It would be difficult to praise too highly the skill shown by the author of this book in making a difficult, extensive and controversial subject intelligible to those who are not specialists in the several sciences which fuse their techniques into those of geochemistry.

Geochemistry, one of the newer tools with which man is learning some of the secrets of creation and of earth processes is defined as the chemistry of the earth and of its parts. As it is explained by Professor Mason of Indiana University, the background of geochemistry lies in our meager knowledge of the earth's relation to the universe, in our somewhat more ample knowledge of the structure of the earth itself, and in our rapidly growing knowledge of crystal chemistry and the forces that cause the elements to group themselves into the minerals met within the rocks.

After three general chapters on these topics, Professor Mason examines the chemistry of magmatism and the igneous rocks, of the sedimentary rocks, of the oceans, the atmosphere and the living things of the earth, and finally, the phenomena of metamorphism.

There are many students of the earth sciences, both enrolled and not enrolled in college courses, for whom this book will be of first importance, because to them it opens new concepts of mineralogical processes; it sheds new light on the underlying forces behind geological phenomena, and it makes this important subject available to the layman. Excellent critical short bibliographies are included with each chapter.

INTRODUCTION TO GEOLOGY, by E. B. Branson and W. A. Tarr, 3d edition. New York: McGraw-Hill Book Co., 492 pp., $5.50.

This is one of the recognized elementary college textbooks revised by Prof. Carl C. Branson, son of the senior author; Mrs. Tarr, widow of the junior author, and by Prof. W. D. Keller but retaining the major features of the 1941 edition. They have brought statistical and scientific information up to date and made some changes in the order of presentation of the chapters, as teaching experience has indicated was necessary. They have also included a number of new illustrations, espe-

(*Continued on page* 48)

Answers: *Test Your Knowledge.* Check the ones you have correct.
a.—(1) Iron pyrite. A mineral composed of iron and sulphur.
b.—(1) The Biblical name for sulphur.
c.—(1) A non-crystalline mineral without shape or form.
d.—(1) A compound (mineral) consisting of elements chemically united with oxygen.
e.—(1) The common or industrial name for SiO_2 or quartz.
f.—(1) A calcareous, limey clay, accumulated in beds of ponds and elsewhere.
g.—(2) Black or so-called industrial diamonds.
h.—(2) The shell-like fracture found in quartz and other minerals.
i.—(2) Partly decayed vegetative matter found in the soil.
j.—(3) The ability of a mineral or metal to withstand heat.
k.—(3) Chloride of silver. Cerargyrite.
l.—(3) A ferruginous (iron) deposit filling the upper part of mineral veins. A hydrated oxide of iron or other metals, resulting from the removal or loss of sulphur from sulphide minerals (ores).
Total—Score 1-6 poor; 7-13 good; 14-20 excellent; 21 perfect.

Classified Ads — Rates: 35 cents a line, 3 lines for $1.00.

ADVERTISING INDEX

cially aerial photographs, and accounts of the eruptions of Paracutin and of the great earthquake in Assam, India, in 1950.

The book itself makes a studied effort to avoid the use of technical terms or complicated explanations, so that it is well adapted to use of persons wishing to learn the major principles of geology for themselves. It is divided into the two major parts, physical and historical geology, but in general little time is devoted to theories of cosmogony or geologic processes at the earth's dawn. Instead, the major emphasis is on those elements of the science which the beginner and the amateur can use in understanding the world around him.

"WHITE GOLD OF SEARLES LAKE," by Favius Friedman. Nature magazine, March, 1952, Vol. 45, No. 3, pp. 131-3. Historical and descriptive popular account of the fabulous borax deposits at this California location.

"THE MINING DISTRICT OF KIRUNA STAD, SWEDEN," by Lucile Carlson. Scientific Monthly, Feb., 1952. Vol. 74, No. 2, pp. 76-83. A well illustrated account of the rich iron ore deposits in Lappland near the Arctic circle.

Bring Your File Up to Date

Back numbers of the Earth Science Digest are still available. Some are in short supply and will soon be gone. If you like this issue of the Digest, you will find much to enjoy in previous issues. All numbers are 35 cents each, or 3 for $1. Below are listed the numbers with principal articles:

1946

October—Minerals of Missouri, by W. D. Keller. Kansas Crystals and Localities, by Allan Graffham.

November—Craters of the Moon National Monument, by H. N. Andrews, Jr. An Alaskan Gold Deposit, by Victor Shaw.

1947

January—Natural Steam Plant, by W. D. Keller. Alaska Gold Trails of '98, by Victor Shaw.

February—Michigan Minerals, by Henry P. Zuidema. A Missouri Ebb and Flow Spring, by W. D. Keller.

April—Famous Lost Mines, The Lost Dutchman, by Victor Shaw. Origin of Dolomite, by Kenneth J. Rogers.

May—Famous Lost Mines, The Lost Pegleg Smith, by Victor Shaw. What Camera for the Earth Scientist, by W. D. Keller.

June—Asbestos, by Eugene W. Nelson. Famous Lost Mines, The Lost Portal, by Victor Shaw.

July—Prospecting With a Geiger Counter. Famous Lost Mines, The Lost Dutch Oven, by Victor Shaw. Notes on Crinoid Research, by Harrell L. Strimple.

August—Nebraska's Marsupial Tiger, by H. P. Zuidema. Lake Superior Agate, Part I, by T. C. Vanasse. Famous Lost Mines, The Lost Arch, by Victor Shaw.

November—Zeolites for Lapidaries, by Richard M. Pearl. Famous Lost Mines, The Lost Tub, by Victor Shaw.

December—What Happened to the Dinosaurs, by Russell C. Hussey. Famous Lost Mines, The Lost Papuan, by Victor Shaw.

1948

January-February—Pollen Grains Write History, by Stanley Cain. Famous Lost Mines, The Lost Gunsight, by Victor Shaw.

March—California Tar Pits, by Dewey W. Linze. Meteorites, by Clell M. Brentlinger. Geology and the Microscope, Part I, by Arnold Goodman.

April—Sir William Logan, Father of Canadian Geology, Part I, by E. J. Alcock. Geology and the Microscope, Part II, by Jerome Eisenberg.

May—Fire Clay, by W. D. Keller. The Barite Group Minerals, by Richard M. Pearl. Sir William Logan, Part II.

June—Colorado Mineral Localities, by Richard M. Pearl. The American Federation and Earth Science Expansion, by Ben Hur Wilson.

July—Digging for Dinosaurs, by Horace G. Richards. How to Clean Mineral Specimens, by Mary Piper.

August—Devil's Tower, Wyoming, by H. P. Zuidema. A History of Fossil Collecting, Part I, by Richard L. Casanova.

September—Forms and Origin of Caves, Part I, by Charles E. Hendrix. Fulgerites, by E. Carl Sink. History of Fossil Collecting, Part II.

October—Forms and Origin of Caves, Part II. Water Witches by W. W. Schidler. History of Fossil Collecting, Part III.

November—Coal Age Flora of Northern Illinois, by Frank L. Fleener. How the Amateur Geologist Can Aid Science, by Gilbert O. Raasch.

December—The Gros Ventre Landslide, Part I, by H. P. Zuidema.

1949

February—The Moonscar Upon the Earth, Part I, by Harald Kuehn. Staurolite in Georgia, by A. S. Furcron. Bryce Canyon National Park, by Roger L. Spitznas.

March—The Moonscar Upon the Earth, Part II. The Geological Survey, by William E. Wrather.

April—Surface Geology at the Border of an Ice Sheet, by C. W. Wolfe.

May—Coal Geology, by Gilbert H. Cady.

June—The Search for Uranium, Part I, by W. S. Savage. Petroliferous Geodes, by Roger L. Spitznas.

July—Scenic Kansas, by Kenneth K. Landes. The Search for Uranium, Part II.

August—Soil Erosion in Southern Russia, by Wilhelm F. Schmidt. The Search for Uranium, Part III.

September—The Blister Hypothesis and Geological Problems, by C. W. Wolfe. The Green River Oil Shales, by Jerome Eisenberg.

October—Mt. Mazama and Crater Lake, by Jerome Eisenberg.

November—Geophysical Exploration With the Airborne Magnetometer, by Homer Jensen.

December—South Central New Mexico's Sinkholes and Craters, by Alfred M. Perkins.

1950

January—The Arkansas Diamond Area, by J. R. Thoenen, etc.

February—Archeology and Geology of Northwestern Alaska, by Ralph S. Solecki.

March—Constriction Theory of Earth Movements, by Rene Malaise. Geophysical Exploration, Part I, by Charles A. Wilkins.

April—Geology of the Mackenzie Delta, Arctic Canada, by Horace G. Richards. Geophysical Exploration, Part II.

May—Teaching Earth Sciences in Secondary Schools, Part I, by Jerome Eisenberg.

June—Geologic History of the District of Columbia, by Martha S. Carr. Teaching Earth Sciences in Secondary Schools, Part II.

July—Atomic Raw Materials, Part I, by Robert J. Wright. A Geologist Visits Europe, by Horace G. Richards. Teaching Earth Sciences in Secondary Schools, Part III.

August—Atomic Raw Materials, Part II. Sedimentation Studies at Lake Mead, by Herbert B. Nichols.

September—Fossil Localities of Northwestern New Mexico, by H. P. Zuidema. Geochemical Prospecting for Ores, Part I, by Jerome Eisenberg.

October—Potential Mineral Resources of Yukon Territory, by H. S. Bostock.

November—Geological Research in Finland, by A. Laitakari.

December—Potholes in the Navajo Sandstone, Zion National Park, by Roger L. Spitznas. The Origin of Sea Water, by Herbert B. Nichols.

1951

January—Evidence for a Primitive Homogeneous Earth, by Harold C. Urey. New Trilobites Described, by Herbert B. Nichols.

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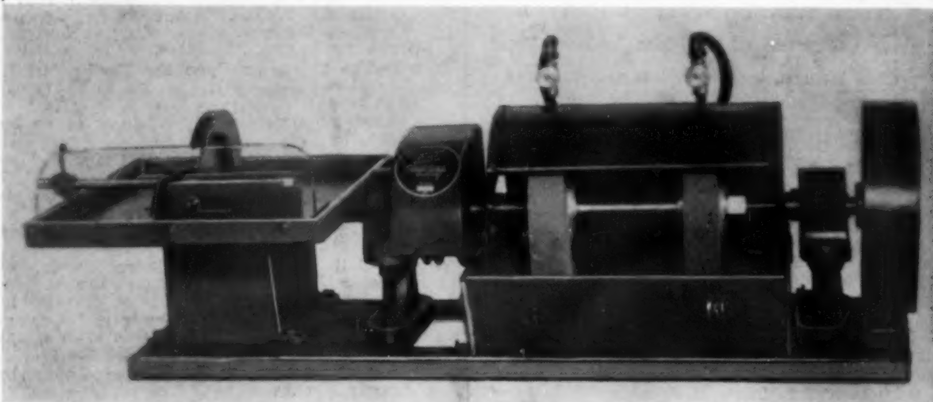

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1/3 H.P. Motor	**18.54**

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